For List of Council and Officers, Conditions of Admission to the Fellowship of the Society, and Society Notices, see pages ii., iv., vi., and viii.

The Geographical Journal.

Authors are alone responsible for their respective statements. In MS. communications all new or unfamiliar geographical names should be written in imitation of Roman type. All communications for the Editor should be addressed to 1, Savile Row, London, W.

CONTENTS—AUGUST.

PAGE

The Garden of Eden and its Restoration. By Sir William Willcocks, K.C.M.G. (with 2 Plates and Map) 129

Northern Nigeria. By Charles Lindsay Temple, C.M.G. (with Map) 149

The Relations of Kames and Eskers. By Prof. J. W. Gregory, F.R.S. (with 1 Sketch-map) 169

The Use of Formulæ in Quantitative Geography. By B. C. Wallis 175

On the Water Supply of Hill Forts in Western India. By F. J. Varley (with 4 Illustrations and 2 Diagrams) 178

The Distribution of Early Bronze Age Settlements in Britain. By O. G. S. Crawford (with 3 Illustrations and 6 Sketch-maps) 184

Reviews:—

EUROPE—British Vegetation. ASIA—China. AFRICA—Carthage and its Surroundings. AMERICA—Physical Geography of the United States. MATHEMATICAL AND PHYSICAL GEOGRAPHY—Two Books on Surveying. GENERAL 203

The Monthly Record 212

EUROPE
- Forest and Settlement in Ancient Germany
- "Transhumance" in Southern France

ASIA
- Native Suspension Bridge over the Dihong (with 2 Illustrations)

AFRICA
- Expedition into the Eastern Desert of Egypt
- The Italian-Abyssinian Frontier in Somaliland
- Lakes of the Kamerun

AMERICA
- Mountaineering in Alaska
- Afforestation in the American Prairies
- Gravity Anomalies and Geological Formations in the United States

AUSTRALASIA AND PACIFIC ISLANDS
- Desert Water-holes in Western Australia
- The German Kaiserin Augusta River Expedition

POLAR REGIONS
- New Projects for Arctic Exploration
- The Japanese Antarctic Expedition

MATHEMATICAL AND PHYSICAL GEOGRAPHY
- Distribution of Electrical Conductivity of the Atmosphere over the Pacific

GENERAL
- Vespucci as a Discoverer and Cosmographer
- The Royal Society Celebration
- The Twelfth International Geological Congress

Obituary—Alexander Knox. By C. F. C. 222

Correspondence—Recent Antarctic Expeditions. By R. N. Rudmose Brown and J. H. Harvey Pirie. Unstead and Taylor's 'Commercial Geography.' By Dr. J. F. Unstead and E. G. R. Taylor 223

Meetings of the Royal Geographical Society, Session 1911–1912 224

Geographical Literature of the Month 224

New Maps 236

MAPS.

Map of the Glacieluvial Kame near Polmont 171

Sketch-maps showing distribution of Celts, Beakers, and Lunulæ 186, 189, 191, 193, 195, 197

Map of Lower Mesopotamia, from the latest Surveys of Sir William Willcocks, K.C.M.G. 240

Map of Northern and Southern Nigeria to illustrate the paper by C. L. Temple, C.M.G. 240

This Journal is obtainable retail in LONDON from Edward Stanford, Ltd., 12, 13, & 14, Long Acre, W.C.; G. Philip & Son, Ltd., 32, Fleet Street, E.C.; and Sifton, Praed & Co., Ltd., 67, St. James's Street, S.W., or from any bookseller in the United Kingdom. Also from the following foreign firms: Barrère, PARIS; Artaria & Co., VIENNA; L. Friederichsen & Co., HAMBURG; D. Reimer, BERLIN; F. A. Brockhaus, LEIPZIG; International News Co., NEW YORK.

ROYAL GEOGRAPHICAL SOCIETY.

PATRON.

HIS MAJESTY THE KING.

VICE-PATRON.

HONORARY PRESIDENT.

Field Marshal H.R.H. the DUKE OF CONNAUGHT, K.G., G.C.M.G.

COUNCIL.

(ELECTED MAY 20, 1912.)

President—The Rt. Hon. Earl CURZON OF KEDLESTON, G.C.S.I., G.C.I.E., F.R.S., etc.

Vice-Presidents.

Admiral Sir LEWIS BEAUMONT, G.C.B, K.C.M.G.
Major LEONARD DARWIN, D.Sc.
DOUGLAS W. FRESHFIELD.
Colonel Sir THOMAS HUNGERFORD HOLDICH, K.C.M.G., K.C.I.E., C.B., R.E.
The Lord LAMINGTON, G.C.M.G., G.C.I.E.
H. YATES THOMPSON, J.P.

Treasurer—EDWARD L. SOMERS COCKS.

Trustees—Right Hon. Lord AVEBURY, D.C.L., LL.D., F.R.S.; Lord BELHAVEN AND STENTON, D.L.

Honorary Secretaries—Colonel Sir D. A. JOHNSTON, K.C.M.G., C.B., R.E.; Captain H. G. LYONS, D.Sc., F.R.S.

Foreign Secretary—Rt. Hon. Sir G. D. TAUBMAN GOLDIE, K.C.M.G., F.R.S., D.C.L.

Members of Council.

TEMPEST ANDERSON, M.D., F.G.S.
Sir HUGH BARNES, K.C.S.I.
Admiral H.S.H. Prince LOUIS OF BATTENBERG, G.C.B., G.C.V.O., etc.
CHARLES W. CAMPBELL, C.M.G.
DOUGLAS CARRUTHERS.
Colonel CHAS. F. CLOSE, C.M.G., R.E.
Prof. STANLEY GARDINER, F.R.S.
ALBERT GRAY, K.C.
Colonel W. C. HEDLEY, R.E.
Colonel R. C. HELLARD, C.B, R.E.
D. G. HOGARTH, M.A.
Sir EVERARD F. IM THURN, K.C.M.G., C.B.
Sir HARRY H. JOHNSTON, G.C.M.G., K.C.B.
G. WM. LAMPLUGH, F.R.S.
T. G. LONGSTAFF, M.D.
Colonel F. R. MAUNSELL, C.M.G., R.A.
Prof. J. L. MYRES, M.A., F.S.A.
Admiral H. E. PUREY-CUST, C.B.
Sir ERNEST HENRY SHACKLETON, C.V.O.
Colonel Sir C. M. WATSON, K.C.M.G., C.B.
Sir FRANK E. YOUNGHUSBAND, K.C.I.E.

Secretary, and Editor of Publications—J. SCOTT KELTIE, LL.D.
Librarian—EDWARD HEAWOOD, M.A.

Map Curator.	Chief Clerk.
EDWARD A. REEVES, F.R.A.S.	S. J. EVIS.

Bankers—Messrs. COCKS, BIDDULPH and Co., 43, Charing Cross.

Candidates for admission into the Society must be proposed and seconded by Fellows, and it is necessary that the description and residence of such Candidates should be clearly stated on their Certificates.

It is provided by Chapter V., § 1, of the Bye-Laws, that—

"Every Fellow shall, on election, be required to pay £5 as entrance fee, and £3 as annual "subscription for the current year, and thereafter a yearly subscription of £3, due on the 1st January "of each year; or he may compound either at entrance by one payment of £45, or at any subsequent "period on the following scale, provided that there shall be at the time no arrears due by him to "the Society:—

Fellows of	10 years'	standing	and under	15	...	£30
"	15 "	"	"	20	...	£24
"	20 "	"	and over		...	£18 15s.

"No Fellow shall be entitled to vote or to enjoy any privilege of the Society while in arrear. "Honorary and Honorary Corresponding Members and Fellows elected under Chapter III., Paragraph "5, are not required to make any payments."

All Subscriptions are payable in advance, on the 1st of January in each year.

The privileges of a Fellow include admission (with one Friend) to all ordinary Meetings of the Society, and the use of the Library and Map-room. Each Fellow is also entitled to receive a copy of all the Society's Periodical Publications.

Copies of the Year Book, Regulations, and Candidates' Certificates may be had on application at the Society's Office, 1, Savile Row, London, W.

LEGACIES Would be a GREAT BOON

TO THE

Great Northern Central Hospital

(Commonly known as the Great Northern Hospital),

HOLLOWAY, N.

No Reserves Available. Annual Expenditure, £18,000.
Assured Income only £6000. Amount needed Annually, £12,000.

27,000 In- and Out-Patients treated per year.

LEWIS H. GLENTON-KERR, Secretary.

SCIENTIFIC & ARTISTIC

ILLUSTRATIONS

BY ALL PROCESSES

BALE & DANIELSSON, LTD.

ARTISTS, PHOTO-ETCHERS, ENGRAVERS, PRINTERS & PUBLISHERS.

83-91 GREAT TITCHFIELD STREET, W.

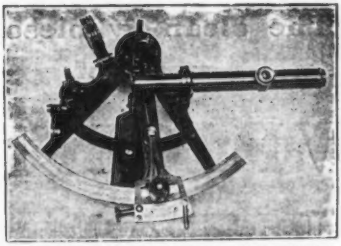
CARY PORTER, LTD. **Traveller's Surveying Instruments.**

7, PALL MALL,
LONDON, S.W.

Established 1765.

BY SPECIAL APPOINTMENT TO THE
Admiralty, War Office, India Office, Ordnance Survey, Crown Agents for the Colonies, Royal Naval and Military Colleges, and other Government Departments. German, Russian, Japanese, and other Foreign Governments.

FACTORY—FINSBURY PARK, N.



Theodolites,
Sextants,
Artificial Horizons,
Telescopes,
Barometers,
Plane Tables,
Binoculars,
Compasses, etc.

Only maker of Reeves' Patent Endless Tangents and Artificial Horizons.

GRAND PRIZE AND GOLD MEDAL—FRANCO-BRITISH EXHIBITION, 1908.

BURROW'S MALVERN WATERS

"Alpha Brand."

The Purest of all Spring Waters

PROMOTE HEALTH. PREVENT DISEASE.

W. & J. BURROW,
The Springs, Malvern.

DELICIOUS COFFEE.

RED WHITE & BLUE

For Breakfast & after Dinner.

ROYAL GEOGRAPHICAL SOCIETY.

NOTICES.*

Year-book for 1912.—The Year-book for 1912 is now ready, and can be obtained on application to the Chief Clerk, 1, Savile Row, W. Price, to Fellows, 1*s.*; to non-Fellows, 2*s.* 6*d.*

The Society's House.—The House is now open to 6 p.m., except on Saturdays, and to 8.30 p.m. on meeting nights. The front room on the first floor of the Society's house is arranged as a Reading-room for Fellows. On a few days of the year it will be required for Meetings of the Council, on which occasions a notice will be fixed outside the door of the room. The House will be closed from August 12 to August 31 inclusive.

Any Fellow desiring to have notice of the subjects of papers to be read at the Society's Meetings forwarded to him, can receive such notices by post on payment in advance to the Chief Clerk, at 1, Savile Row, of 2*s.* per session.

* See also pp. vi., viii., and x.

The clean, wholesome
smell of

WRIGHT'S
COAL TAR SOAP

is, in itself, a
recommendation, and the

freshness felt after using is
really Exhilarating.

Good for Prickly Heat and wards off Insect Bites.

The best nightcap.

Before retiring take a cup of the 'Allenburys' Diet which induces restful sleep and nourishes the system. Affords an excellent light repast, and is preferable to alcoholic stimulants. Prepared from pure milk and whole wheat, in a partially predigested form, and is delicious to take. **Made in a minute—add boiling water only.**

Of Chemists, 1/6 and 3/- per tin

Large Sample sent on receipt of 3d. stamps

ALLEN & HANBURYS Ltd.
— 37, Lombard Street, London. —

Experience has taught that no expedition may be considered to be completely and thoroughly equipped without a plentiful supply of

BOVRIL

KEEPS GOOD FOR ANY LENGTH OF TIME.

PROVISIONS AND OUTFIT.

GRIFFITHS, McALISTER & Co.,

EXPORT PROVISION MERCHANTS, ETC.,

29-31, Manesty's Lane, Liverpool. 14, Billiter St., London, E.C.

Suppliers of all kinds of Provisions, Camp Equipment, Medical Stores, Wines, Spirits, and Mineral Waters, &c., for Exploring and Mining Expeditions; also for private use abroad.

All Goods suitably packed for Hot and Cold Climates, and made up in loads suitable for all modes of Transport.

Suppliers to Lieut. Shackleton's Antarctic Expedition, 1907-1909.

CONTRACTORS TO THE CROWN AGENTS FOR THE COLONIES.

Telegraphic Addresses: "COOMASSIE," LIVERPOOL. "APPEASABLE," LONDON. Codes used: A, B, C, 4th and 5th Editions and Lieber's.

ESTABLISHED 1880.

Harwich Route to the Continent

viâ the **HOOK OF HOLLAND** (British Royal Mail Route) Daily, viâ **HARWICH-ANTWERP** Daily (Sundays excepted).

THE BOAT EXPRESS leaves London, Liverpool Street Station, at 8.30 p.m., for the HOOK OF HOLLAND. Corridor Vestibuled Train with 1st and 2nd Class, Breakfast and Dining Cars; no Supplementary Charge for Seats.

THE BOAT EXPRESS leaves London, Liverpool Street Station, at 8.40 p.m., for ANTWERP. Corridor Vestibuled Train with 1st and 2nd Class, Breakfast and Dining Cars; no Supplementary Charge for Seats.

Turbine Steamers only on the Hook Service.
Wireless Telegraph and Submarine Signalling.

Details of the Continental Manager Great Eastern Railway, Liverpool Street Station, London.

NOTICE.

PHOTOGRAPHS.

ROYAL GEOGRAPHICAL SOCIETY.

It would greatly add to the value of the Collection of Photographs which has been established in the Map Room of the Royal Geographical Society, if all the Fellows who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they would be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

THE BLUE FUNNEL LINE

To SOUTH AFRICA and AUSTRALIA.

Superior Saloon Accommodation — *Fares:* South Africa £22 10s. to £27 10s. — Australia £40 to £45 — Only One Class Carried.

For full particulars apply to—

ALFRED HOLT & CO., India Buildings, Liverpool.

HOLIDAYS AND TOURS IN CANADA.

Travel by the

Canadian Northern Royal Line

R.M.S. ROYAL GEORGE.
R.M.S. ROYAL EDWARD.

FASTEST STEAMERS IN THE CANADIAN TRADE.

Fitted with Marconi Apparatus; also Submarine Signals.

PALATIAL SALOONS. REGAL SUITES.
UNSURPASSED CUISINE AND SERVICE.

Magnificent Sporting Territory. Hunting—Camping—Canoeing—Fishing.

FOR FULL INFORMATION, BOOKLETS, ETC., APPLY

Head Offices: BOND COURT, WALBROOK, LONDON, E.C.

Ticket Offices: Baltic House, 27, Leadenhall Street, E.C.; 21, Charing Cross, S.W.; 65, Haymarket, S.W., London; 65, Baldwin Street, Bristol; Chapel Street, Liverpool; 141, Corporation Street, Birmingham; 125, Hope Street, Glasgow; 1 bis, Rue Scribe, Paris.

Equi-pede Burberry
covers rider from neck to boots, and makes him immune to weather and climate.

GABARDINE

THE ONE material for the Explorer—his Suits, his Overcoats and his Tents; armour of proof to the weather; shield against thorns; indemnity from roughest wear.

BURBERRY WEAVE AND PROOF combine to produce fabrics especially adapted for outrigs for use in exotic climates, because they:—

Efficiently resist heavy rain and dew.
Are so light in weight that they minimise fatigue.
Ventilate naturally.
By close weaving render night mist and chill innocuous.
Are practically untearable and impenetrable by thorns.
Their proofing is permanent and their durability incalculable.
They are proofed without rubber.

Gabardine Suit
gives absolute liberty and protection.

"GABARDINE" (Reg. Trade Mark) is only obtainable in Burberry garments, all of which are labelled "BURBERRYS."

"GABARDINE IN PEACE AND WAR."

A handbook which deals practically with equipment in every part of the world, from the Poles to the Equator, and enumerates the supreme advantages which Gabardine has conferred upon every department of out-door life.
Fully illustrated with some 50 full-page pictures, including portraits of distinguished users of Gabardine, and specially drawn sporting sketches by a well-known artist.

A COPY POST-FREE ON REQUEST.

BURBERRYS HAYMARKET, S.W., LONDON.
8 & 10, Boulevard Malesherbes, PARIS.

GRAND TRUNK RAILWAY

SPECIAL TOURS IN

CANADA

ARRANGED TO MEET YOUR PARTICULAR REQUIREMENTS BY

PASSAGES BOOKED BY ANY STEAMER.

CANADA'S GRAND TRUNK RAILWAY

ASK FOR ILLUSTRATED HOLIDAY BOOKS.

EUROPEAN TRAFFIC OFFICES (DEPT. B.G.):

LONDON, S.W.—17-19, Cockspur Street; LIVERPOOL—20, Water Street; GLASGOW—75, Union Street; SHEFFIELD—7, Haymarket; BIRMINGHAM—6, Victoria Square; BELFAST—11, Lower Garfield Street.

GREAT TOURIST ROUTE

NOTICE.

INSTRUCTION FOR INTENDING TRAVELLERS.

Under the authority of the Council of the R.G.S.

Arrangements have been made for the instruction of intending travellers in the following subjects:—

Surveying and Mapping, including the fixing of positions by Astronomical Observations. By Mr. E. A. REEVES, F.R.A.S., Map Curator of the Society.

Geology, including practical training in the field. Under the superintendence of the Director General of the Geological Survey.

Botany. Under the superintendence of the Director, Royal Gardens, Kew.

Zoology. Natural History Museum, South Kensington.

Anthropological Measurements. Under the superintendence of the Anthropological Institute.

Photography. By Mr. JOHN THOMSON, Author of 'Photographic Illustrations of China and its People,' and other works.

Meteorology. By Dr. H. R. MILL.

Outfit and Health. Dr. CHARLES F. HARFORD, Secretary of the Travellers' Health Bureau.

The Lessons are given on days and at hours arranged between the Instructor and the pupil. Tickets for the lessons, at 2*s.* 6*d.* for each hour's lesson, must be previously procured at the Offices of the Society.

COUNTRY HOUSE LIGHTING

BY THE SILVERTOWN PETROL-ELECTRIC PLANT

The most reliable and economical method of generating electric power for Lighting, Vacuum Cleaning, Ventilation, Pumping, Dairy and Laundry Machinery and Stable and Garage purposes.

The up-keep of the Silvertown Petrol Electric Plant is very low, and about half an hour per day will meet every requirement in the matter of attention.

PRICES ON APPLICATION.

The India Rubber, Gutta Percha & Telegraph Works Co., Ltd.

Head Offices: 106 CANNON STREET, LONDON, E.C.

Works: SILVERTOWN, LONDON, E.

BRANCHES: Belfast, Birmingham, Bradford, Bristol, Cardiff, Dublin, Glasgow, Liverpool, Manchester, Newcastle-on-Tyne, Portsmouth, Sheffield.

KEATING'S POWDER KILLS FLEAS BUGS BEETLES

TINS 1ᴰ 3ᴰ 6ᴰ & 1/-

NATURAL HISTORY

WATKINS & DONCASTER

NATURALISTS

36, STRAND, LONDON, W.C.

(Five Doors from Charing Cross)

keep in stock every description of Apparatus, Cabinets, Books, and Specimens for Collectors of

BIRDS' EGGS, BUTTERFLIES AND MOTHS, &c.

Price List sent post-free on application.

NOTICE TO TRAVELLERS.

To travel without trouble is the desire of everyone. During the past seventy years we have devised many methods having that object as their raison d'etre, amongst them being the well-known methods of "Select Conducted Parties" and "Popular Tours."

Without enumerating them all, we may draw the reader's attention to one. The advantages and facilities attaching to our

INTERNATIONAL TRAVEL TICKETS

which are available all over the world for purely Independent Travel are known to everyone, being in use by every description of traveller, including members of the Royal Family of England and of almost every European country.

Their utility has recently been increased by the method of

INCLUSIVE INDEPENDENT TRAVEL

the very latest word in the art of travel without trouble. By Inclusive Independent Travel is meant that, not only is practically every expenditure necessary to a tour included in the fare, but that the details for the entire journey are so thoughtfully worked out and pre-arranged that the traveller moves on his journey with a freedom from trouble hitherto undreamt of in independent travel.

The method can be applied to tours on which it is required to travel economically, as well as to those wherein the acme of luxurious travel is desired.

We shall be pleased to send an explanatory booklet from any of our offices.

THOS. COOK & SON,

Chief Office: LUDGATE CIRCUS, LONDON.

BRITISH COLUMBIA,

CANADA'S MOST WESTERLY PROVINCE.

OFFERS INNUMERABLE ATTRACTIONS TO THE TOURIST AND SPORTSMAN.

SPLENDID SCENERY.—CLIMATE HEALTHY AND DELIGHTFUL.—A LAND OF FRUIT AND FLOWERS.—THE SPORTSMAN'S PARADISE.

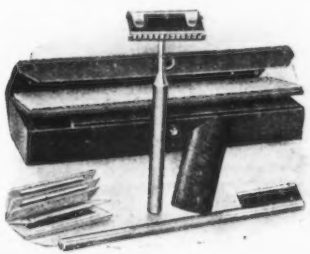
Abounds in Game of all kinds, Large and Small Birds, Good Fighting Fish, including an abundance of Salmon and Trout. The Home of the Wapiti, Mountain Goat, Bighorn and Grizzly.

Full Particulars and Pamphlets on application to J.H.TURNER, Agent-General for B.C., Salisbury House, Finsbury Circus, London.

"CHRISTY" SAFETY RAZOR

5/= Complete with Strop Holder and Strop and **Six Blades** of best Sheffield Steel.

Quick Action. Good Clean Shave.



On Sale Everywhere.

ROYAL GEOGRAPHICAL SOCIETY.

THE SOCIETY'S PUBLICATIONS.

THE GEOGRAPHICAL JOURNAL. Issued Monthly. Delivered free to all Fellows; price to Non-Fellows, 2s.

GENERAL INDEX TO THE FIRST 20 VOLUMES OF THE GEOGRAPHICAL JOURNAL, 1893–1902. 660 pages, double columns. Price, to Fellows, 6s. 6d. net; to Non-Fellows, 10s. 6d.

JOURNAL OF THE ROYAL GEOGRAPHICAL SOCIETY (OLD SERIES), 1830–1880. 50 volumes, 8vo. Price, to Non-Fellows, £1 per vol. net; to Fellows, 15s. per vol.

PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY (OLD SERIES), 1855-1878. 22 volumes, 8vo. In parts, to Non-Fellows, 1s.; to Fellows, 9d. per part.

PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY (NEW SERIES), consists of 14 volumes, extending from 1879 to 1892. 18s. per vol.; the series now offered for £6.

SUPPLEMENTARY PAPERS.
Containing a large number of Memoirs and Narratives of considerable length, besides several valuable Bibliographies; over 30 Maps and numerous Illustrations. Sold for half price, £2 for the four volumes.

HINTS TO TRAVELLERS.—The ninth revised edition, edited, under a Committee of the Council, by E. REEVES, F.R.A.S., Map Curator and Instructor to the Society. Price 15s. net; to Fellows, at the House of the Society, 10s.

TRIGONOMETRY—PLANE AND SPHERICAL. Specially arranged for the use of Students attending the Royal Geographical Society's course of Instruction. By E. A. REEVES, F.R.A.S. Price 5s. net.

HINTS ON OUTFIT FOR TRAVELLERS IN TROPICAL COUNTRIES. By CHARLES FORBES HARFORD, M.A., M.D. Second edition. Price 1s. net.

CATALOGUE OF THE LIBRARY OF THE R.G.S. Edited by Dr. H. R. MILL. Price, to Fellows, 2s. 6d. net; to Non-Fellows, 5s.

THE YEAR-BOOK OF THE SOCIETY. Issued annually. Price, to Non-Fellows, 2s. 6d.; Fellows, 1s.

SYLLABUSES OF INSTRUCTION IN GEOGRAPHY. I. In Elementary Schools. II. In Secondary Schools. Single copies gratis on application at 1, Savile Row, W.

MAPS AND MAP-MAKING. By E. A. REEVES. Numerous Illustrations. Price, to Fellows, 6s. net; to non-Fellows, 8s. net.

THE FIFTY YEARS' WORK OF THE ROYAL GEOGRAPHICAL SOCIETY. By Sir CLEMENTS R. MARKHAM, K.C.B., F.R.S., President. 255 pp. Price, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. net.

THE LANDS OF CAZEMBE. LACERDA'S JOURNEY TO CAZEMBE IN 1798. Translated and annotated by Captain R. F. BURTON. 271 pp., with Map. Also Journey of the Pombeiros, P. J. Baptista, and Amaro José, across Africa from Angola to Tette on the Zambeze. Translated by B. A. BEADLE. And a *Résumé* of the Journey of MM. Monteiro and Gamitto. By Dr. C. T. BEKE. Price, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. net.

THE TOPOGRAPHY OF THE BATTLE OF PLATÆA. By G. B. GRUNDY, B.A. Price, bound in half-calf, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. net.

NOTES ON THE KURIL ISLANDS. By Captain H. J. SNOW. 8vo, 88 pp., with two large Charts, revised by Captain SNOW. Price, in boards, to Non-Fellows, 4s. net; to Fellows, 2s. net.

EASTERN PERSIAN IRAK. By General A. HOUTUM-SCHINDLER. 8vo, 132 pp., with Map. Price, to Non-Fellows, 5s. net; to Fellows, 3s. net.

A JOURNEY ON THE UPPER MEKONG, SIAM. By H. WARINGTON SMYTH. Sixty Illustrations and three Maps. Price, to Non-Fellows, 7s. 6d. net; to Fellows, 4s. net.

BIBLIOGRAPHY OF ALGERIA, FROM THE EXPEDITION OF CHARLES V. IN 1511 TO 1887. By Sir R. L. PLAYFAIR. Price, to Non-Fellows, 7s. 6d.; Fellows, 5s. net. [net.

EDUCATIONAL REPORTS. By Dr. J. SCOTT KELTIE. Price, to Non-Fellows, 5s.; to Fellows, 2s. 6d.

SUPPLEMENT TO THE BIBLIOGRAPHY OF ALGERIA, FROM THE EARLIEST TIME TO 1895. By Sir LAMBERT PLAYFAIR, K.C.M.G. Price, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. net.

MAP OF THE KARAKORAM HIMALAYAS. In two sheets, with text. By Sir W. MARTIN CONWAY, M.A. Price, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. net.

SURVEYING AND EXPLORING IN SIAM. By JAMES MCCARTHY. Large Maps of Siam and many Illustrations. 236 pp. 8vo. Price, to Non-Fellows, 10s. 6d. net; to Fellows, 6s. 6d. net.

THE DISTRIBUTION OF RAINFALL OVER THE LAND. By Dr. A. J. HERBERTSON. Price, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. net.

ON THE RESULTS OF A DEEP-SEA SOUNDING EXPEDITION IN THE NORTH ATLANTIC DURING THE SUMMER OF 1899. By R. S. PEAKE, M.INST.C.E. With Notes on Temperature, Deep-Sea Deposits, &c. By Sir JOHN MURRAY, K.C.B., F.R.S. Price, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. net.

ARCTIC PAPERS FOR THE EXPEDITION OF 1875. A selection of Papers on Arctic Geography and Ethnology. Reprinted and presented to the Arctic Expedition of 1875, by the President, Council, and Fellows of the Royal Geographical Society. Price, to Non-Fellows, 7s. 6d. net; to Fellows, 5s. net.

THE ANTARCTIC MANUAL, FOR THE USE OF THE EXPEDITION OF 1901. Edited by GEORGE MURRAY, F.R.S. 602 pp. royal 8vo. Price, to Non-Fellows, 15s. net; to Fellows, 10s. net.

JOURNEY TO LHASA AND CENTRAL TIBET. By SARAT CHANDRA DAS, C.I.E. Edited by the Hon. W. W. ROCKHILL. Maps and Illustrations. 285 pp. 8vo. Price, bound in cloth, to Non-Fellows, 10s. 6d. net; to Fellows, 7s. net.

NEW MAP OF THE RIVER CONGO, in Ten Sections on Five Sheets. Scale 1 : 500,000 (8 miles = 1 inch). By the Rev. GEORGE GRENFELL. In small portfolio, with Memorandum. Price, to Non-Fellows, 10s. net; to Fellows, 6s. net.

ON RECENT CONTRIBUTIONS TO OUR KNOWLEDGE OF THE FLOOR OF THE NORTH ATLANTIC OCEAN. By Sir JOHN MURRAY, K.C.B., F.R.S., and R. E. PEAKE, M.INST.C.E. Price, to Non-Fellows, 5s. net; to Fellows, 2s. 6d. net.

AN EXPEDITION INTO THE CENTRAL TIAN-SHAN MOUNTAINS. By Dr. GOTTFRIED MERZBACHER. Price, to Non-Fellows, 12s. net; to Fellows, 9s. net.

MAP OF TIBET. New edition, 1906. Price, to Fellows, 3s. net; to Non-Fellows, 5s. net.

GEOGRAPHICAL DISTRIBUTION OF VEGETATION IN SOMERSET. By Dr. C. E. MOSS. Price, to Fellows, 2s. 6d. net; to Non-Fellows, 5s. net.

BIBLIOGRAPHY OF TOPOGRAPHICAL AND GEOLOGICAL WORKS ON THE PHLEGRÆAN FIELDS. By R. T. GÜNTHER. Price, to Fellows, paper covers, 2s. 6d., boards, 3s. net; to Non-Fellows, paper covers, 5s., stiff boards, 6s. net.

NATIONAL ANTARCTIC EXPEDITION, 1901–4. Charts of the Expedition, with Memoir by Lieut. G. F. A. MULOCK, R.N. Price, to Non-Fellows, 12s. 6d. net; to Fellows, 9s. net.

MOUNTAIN PANORAMAS FROM THE PAMIRS AND KWEN LUN. With Introduction and Descriptions by Dr. M. AUREL STEIN. Price, to Non-Fellows, £1 net; to Fellows, 14s. net.

BATHYMETRICAL SURVEY OF THE FRESHWATER LOCHS OF SCOTLAND. Under the direction of Sir JOHN MURRAY, K.C.B., F.R.S., and LAURENCE PULLAR, F.R.S.E. Maps and Illustrations. Price, to Fellows, 15s.; to Non-Fellows, 21s. net.

RESEARCHES IN PTOLEMY'S GEOGRAPHY OF EASTERN ASIA. By Colonel G. E. GERINI. 970 pages, with Maps. Price 15s. net; to Fellows, 12s.

NEW MAP OF EASTERN TURKEY-IN-ASIA. Scale of 1 : 2,000,000 (32 miles to an inch), with accompanying text, in case. Price to Fellows, unmounted, 5s. net, mounted, 6s. 6d. net; to non-Fellows, unmounted, 8s. 6d. net, mounted, 10s. SPECIAL EDITION, with ancient names in red. Price, to Fellows, unmounted, 6s. net, mounted 7s. 6d.; to non-Fellows, unmounted, 9s. 6d. net, mounted, 11s.

Telephone No. 5197 Gerrard.

MARTIN, HOOD & LARKIN,

Specialists in the

REPRODUCTION of MAPS and PLANS,

Lithographers and General Printers,

8, Gt. NEWPORT ST., LONDON, W.C.

ALL KINDS OF

Maps, Plans, and Charts.

DOULTON'S

1909 Patent

TRAVELLER'S PUMP FILTER

ASSURES

Pure Drinking Water

Vide *British Medical Journal* and *Journal of Hygiene.*

OBTAINABLE THROUGH ALL STORES AND OUTFITTING HOUSES.

ROYAL DOULTON POTTERIES,

Lambeth, London, S.E.

The Irrigation of Mesopotamia

By

SIR W. WILLCOCKS,

K.C.M.G., F.R.G.S.

Adviser to the Turkish Ministry of Public Works, Constantinople

CONTENTS

Introduction—Nomenclature—The Delta an Arid Region—Discharges of the Rivers—Area capable of being irrigated—Whole Delta incapable of being irrigated simultaneously—Selection of Tracts for Irrigation—Hindia Barrage—Provision for Excessive Floods on the Euphrates—Provision for excessive Floods on the Tigris—Proposed Feluja Barrage on the Euphrates—Right Tigris Canal System—Left Euphrates Canal System—Drainage and Forests—Escapes—Navigation of the Tigris—Koot Barrage and Hai System—Basra Reclamation Works—Subsidiary Works on the Hindia Branch—Beled Barrage System—Nahrwan Canal and Dyala Diversion—Financial Aspects—Staff of Mesopotamia Irrigation Survey—Report on the Survey—Agricultural Possibilities of Mesopotamia—Meteorology of Mesopotamia—Meteorological Data, 1901-10—Analysis of Soils and Water—Analysis of Materials—Report on Labour, Materials and Transport—Report on Brick Manufacture—Report on the Machinery at the Barrage—Earthwork Rates for the Rohri Canal (North India)—List of Plans—Details of Estimates of Cost of Works—Discharges taken in 1909-10—Railways.

2 vols., 46 plates, and 136 pp. (Text, super royal 8vo; Plates, folio). Net. 21/- post free.

E. & F. N. SPON, LTD.,

57, Haymarket, London, S.W.

ROYAL GEOGRAPHICAL SOCIETY.

NEW EXTRA PUBLICATIONS.

Researches on Ptolemy's Geography of Eastern Asia (Further India and Indo-Malay Archipelago).

By Colonel G. E. GERINI, M.R.A.S.

Published in conjunction with the Royal Asiatic Society. 970 pages, with maps. Price 15*s.* net; to Fellows, 12*s.*

New Map of Eastern Turkey-in-Asia, Syria, and Western Persia.

On the scale of 1 : 2,000,000, or 32 miles to an inch, with accompanying text, in case, with pocket for map. Price to Fellows, unmounted, 5*s.* net, mounted in cloth, 6*s.* 6*d.* net; to non-Fellows, unmounted, 8*s.* 6*d.* net, mounted, 10*s.*

SPECIAL EDITION, with Babylonian and Assyrian names in red. Price to Fellows, unmounted, 6*s.* net, mounted in cloth, 7*s.* 6*d.*; to non-Fellows, unmounted, 9*s.* 6*d.* net, mounted, 11*s.*

This Label

THE CELLULAR CLOTHING CO. LTD. AERTEX LONDON

on all Garments.

AERTEX CELLULAR

Enables your whole body to BREATHE.

An Ideal Suit of Summer Underwear for 5/-

AERTEX CELLULAR consists of small cells containing air which is an excellent non-conductor of heat. The body thus clothed maintains its normal temperature, being surrounded by a gradually changing layer of air without direct contact with the outer atmosphere, hot or cold weather making no difference. The action of the pores of the skin is not impeded when Aertex Cellular is worn and the wearer enjoys a delightful sense of freedom, lightness and comfort.

Illustrated Price List of full range of Aertex Cellular Goods for Men, Women and Children, with list of 1,500 Depots where these goods may be obtained, sent Post Free on application to THE CELLULAR CLOTHING CO., LTD., Fore Street, London, E.C.

A Selection from List of Depots where AERTEX CELLULAR goods may be obtained.

LONDON RETAIL AGENTS—

City: ROBERT SCOTT, Ltd., 8, Poultry, Cheapside, E.C.

West End: OLIVER BROTHERS, Ltd., 417, Oxford St., W.

Dr. J. Collis Browne's Chlorodyne

Of all Chemists, 1/1½, 2/9, and 4/6.

The Original and Only Genuine.

The Best and Surest Remedy for

COUGHS, COLDS, ASTHMA, BRONCHITIS,

Cuts short all attacks of SPASMS, HYSTERIA and PALPITATION.

The only Palliative in NEURALGIA, GOUT, RHEUMATISM, TOOTHACHE.

Acts like a charm in DIARRHŒA, CHOLERA, and DYSENTERY.

Convincing Medical Testimony with each Bottle.

Universally acknowledged to be the Most Valuable Medicine known. Doctors and the public in all parts of the world have used it with unvarying success for upwards of 60 years, and have amply testified to its efficacy.

The secret of its manufacture has never been divulged, and compounds called Chlorodyne cannot possess the same curative virtues. Purchasers, therefore, should see that the name

Dr. J. Collis Browne's

is on the stamp, and emphatically **refuse substitutes.**

INDEX TO ADVERTISEMENTS.

Where no number is given, the Advertisement does not appear this month.

PAGE

Account Book Makers.
Brown & Rowley 15

Bookbinders, Booksellers, &c.
Potter, Wm. .....
Sotheran & Co. .....*Cover* 2

Boots and Shoes.
Dowie & Marshall 13

Charities.
Dr. Barnardo's Homes .....
Great Northern Central Hospital 3

College.
Thames Nautical Training .....

Cutlery.
Hill & Son.....

Filters.
Doulton & Co., Ltd. 11

Foods for Travellers.
Allen & Hanburys Ltd. 5
Bovril 5
Lea & Perrins' Sauce 14
Lemco 14
Oxo..... 14
Red, White & Blue Coffee 3
Zotos 15

Furniture and Floor Polish.
Ronuk, Limited 16

Hotels and Restaurants.
Hôtel Métropole 15

Instruments for Travellers.
Cary, Porter, Ltd. 3
Clarkson & Co. 13

Insurance.
Eagle Insurance Co.....
London and Lancashire .....
Scottish Widows' Fund .....

Land Agents.
Watson Lyall, J. & Co., Ltd. 16

PAGE

Lighting.
India Rubber Co. 8

Medicines & Medicine Cases.
Browne, Dr. Collis 12
Burroughs Wellcome & Co .....
Dinneford & Co.....*Cover* 2
Evans, Lescher & Webb, Ltd. ...
Parke, Davis & Co. 15
Zotos 15

Naturalists.
Watkins & Doncaster 8

Outfitters.
Cellular Clothing Co..... 12
Dowie & Marshall 13
Griffiths, McAlister & Co. 5
Silver, S. W., & Co., and Benjamin Edgington .....*Cover* 4
Tucker, Joseph .....

Pencils.
Koh-i-noor.....

Photo Engravers.
Bale, Sons, & Danielsson, Ltd. 3

Photographic.
Autotype Co. .....
Burroughs Wellcome & Co. .....

Pictures.
Imperial Fine Art Corporation

Portable Buildings.
Boulton & Paul.....

Publishers.
Arnold, E. .....
Constable & Co., Ltd. .....*Inset*
Financial Review of Reviews *Cover* 4
Macmillan & Co., Ltd. .....
Pulip, G., & Son, Ltd. .....
Spon, E. & F. N.....
Stanford, Edward .....

PAGE

Railways.
Canada's Grand Trunk Railway 7
Canadian, Northern 6
Great Eastern Railway 5

Razors.
Christy Safety 9

Soaps.
Wright's Coal Tar 4

Sporting: Game, etc.
British Columbia 9
Canada's Grand Trunk Railway 7

Sporting Outfits.
Burberrys 7

Steamships—
Blue Funnel Line 6

Stores for Expeditions, &c.
Bishop, A. E..... .....*Cover* 3
Griffiths, McAlister & Co..... 5
Keating's Powder 8
Silver, S. W., & Co., and Benjamin Edgington .....*Cover* 4

Stoves.
Poore, Wm., & Co. 13

Table Waters.
Burrows..... 3

Tents.
Burberrys 7
Silver, S. W., & Co., and Benjamin Edgington .....*Cover* 4
Tucker, Joseph .....

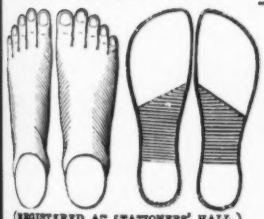
Tours and Excursions.
Cook, T., & Son 9
Grand Trunk Railway 7
Orient Line 6
Royal Line 6

Turkish Baths.
Charing Cross .....

Typewriters.
Oliver Typewriter Co., Ltd.....

Wines and Spirits.
Deuts & Geldermann ..... *Cover* 2
Heidsieck, Charles ..... *Cover* 2

BOOTS FOR EXPLORERS.



(REGISTERED AT STATIONERS' HALL.)

DOWIE & MARSHALL

(Established 1824)

Have for many years made a special study of the various kinds of boots required for different climates, and they have had the gratification of pleasing many Travellers, including members of the R.G.S., from the time of Dr. John Rae of Arctic renown to Sir H. M. Stanley, the African Explorer.

Country Customers should send, as guide to measurement, a pair of old boots and outlines of the feet.

Only the best hand-sewn Boots are made.

455, WEST STRAND LONDON.

G.P.O. Telephone No. 9015 Central. **(3 doors from Trafalgar Square.)**

CLARKSON'S

SECOND-HAND OPTICAL MART,

338, HIGH HOLBORN, W.C.

(Opposite Gray's Inn Road).

Sextants, Theodolites, Surveyors' Instruments, Prism Binoculars, Telescopes, and other Second-hand Optical Instruments by the best makers.

Telephone: 2149, HOLBORN.

All communications respecting Advertisements in the

"GEOGRAPHICAL JOURNAL"

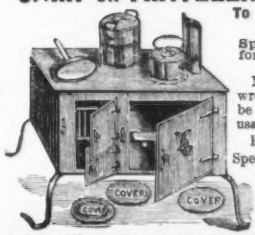
to be sent to

G. STREET & CO., LTD.,

8, SERLE STREET, LINCOLN'S INN, W.C.

THE WROUGHT IRON

CAMP OR TRAVELLING STOVE



To burn wood or any fuel.

Specially designed for Explorers, Missionaries, etc.

Made of malleable wrought iron. Cannot be injured by rough usage. Weight 36 lbs.

Price complete, £3.

Specialities in Oil Cooking Stoves for Home and Export. Any kind of stove made to order.

Send for a 100-page Illustrated Catalogue of Stoves for all purposes, which will be sent free by mail on application.

WILLIAM POORE & CO.,
52, Queen Victoria Street, London, E.C.

LEA & PERRINS' SAUCE

with Fish.

The Original and Genuine
WORCESTERSHIRE.

BY APPOINTMENT TO HIS MAJESTY THE KING

For Expeditions!

5,000,000 Acres of Cattle Farms.
350,000 Head of Cattle.
500 Acres of Factories.

Famous explorers have proved, time and again, that one of the most vitally important items of their equipment is a supply of Lemco or Oxo. Both in the kitchen and hospital tent they have a hundred valuable uses, and are absolutely reliable in all emergencies.

LEMCO—the original Liebig Company's Extract of Beef, introduced in 1865—the most scientifically-perfect Beef Essence in existence. Keeps for any time in any climate.

OXO—the well-known fluid-beef, rich in the nourishing beef-proteid, that builds up the body, and in the extractives that give stimulation and promote food-absorption.

Made Solely by Liebig's Extract of Meat Co., Ltd., Originators of Concentrated Beef Foods, etc., etc.

LEMCO and OXO

THAMES HOUSE, LONDON, E.C.

The
Geographical Journal.

No. 2. AUGUST, 1912. Vol. XL

THE GARDEN OF EDEN AND ITS RESTORATION.*

By Sir WILLIAM WILLCOCKS, K.C.M.G.

Lecturing in November, 1909, in this hall, on "Mesopotamia, past, present and future," I placed the Garden of Eden of our Bible on the upper Euphrates between Anah and Hit. Here must have been the first civilized settlement of the Semites, the ancestors of the children of Israel, as they moved down from the north-west. And it may interest some to know that in the latitude of this region, not far from Damascus, wild wheat plants have within recent years been discovered. The wearing down of the cataracts deprived the settlers of the waters of the friendly river which had watered their garden, and they travelled eastwards and could see behind them nothing but the bitumen springs on the east of Eden, which seemed to them like flaming swords in the hands of the offended seraphim. Like all early peoples they called themselves the sons of God, and in their journey they soon encountered the sons of men who had already conquered the Tigris-Euphrates delta, and among whom had settled those of their sons whose hands were stained with blood and who could no longer be permitted to reside in the tents of their tribe. To-day I shall begin by describing the location of the Garden of Eden of these sons of men who had made their first settlement in the extreme south-east of the delta of the two rivers, and who had spread over the land, advancing westwards and north-westwards. Known as the people of Sumer and Akkad, or the Hollanders and Uplanders, they had made their earliest reclamation works in the marshes near the Persian gulf.

> "When in the height heaven was not named,
> And earth beneath had no signification,
> Hurrying, confusing, the Floods were conceiving them,
> Urged by their tides, the Seas were engendering them;

* Royal Geographical Society, June 10, 1912. Map, p 240.

The waters of Chaos were surging together;
And no field was formed, no marsh was to be seen.

. . . . . .

The holy house, the house of the gods, in the holy place had not been made;
No reed had sprung up, no tree had been created."

As these people understood nature, the river by itself could not begin life until its waters had mingled with those of the sea, and from their union, under the action of the flux and reflux of the tides, sprung the marshes where life began on earth. As a matter of fact, salt water never reaches the marshes, owing to the delta of the Karun lying between them and the sea. The effect of the 10-foot tide in the gulf is communicated to the rivers, and travels up nearly 100 miles, but no salt water gets into the marshes. To the writers of these very early epics the Deep was a fresh-water deep.

"O thou river, who didst bring forth all things,
When the great gods dug thee out,
They set prosperity upon thy banks.
Within thee dwelleth Ea, wise god of the marsh.

. . . . . .

Traversing wide marshes was the river,
When Eridu was made, when E-Sagil was built,
E-Sagil, the abode of the greatest of the great gods of heaven.
Marduk laid reeds in the face of the waters,
He piled up earthen banks and sheltered them behind the reeds,
That he might cause the gods to dwell in the habitation of their hearts' desire."

With translations of the Babylonian tablets of creation in my hand, and the plans and levels of the country before me, I have endeavoured, on the spot, to give local colour to the passages describing the Garden of Eden of Sumer and Akkad. After some thousands of years, the Euphrates in these reaches is again traversing wide marshes. For some 70 miles in length the river has left its old channel, and flowing over a flat plain some 12 miles wide, is covering it with 2 or 3 feet of water. I have seen Arabs taking reeds and earth and throwing up well-protected banks in the time of low supply, and so enclosing areas of land for cultivation and habitation, which will be safe from the attacks of the dragon of the Euphrates.

In my first lecture I had stated that the Garden of Eden of the Semites must have been near an outcrop of hard rock as we see it at Anah up-stream of Hit, where water could be led off from above a rapid and utilized for irrigating, with free flow, gardens situated a little down-stream and above the reach of the highest floods. Below Hit, no place could be found for a garden without lifting apparatus or protecting dykes; because, otherwise, any garden irrigated in the time of low supply would be inundated in flood, and if irrigated in flood would be left high and dry in the time of low supply. Since then I have studied on the spot the scriptures of Sumer and Akkad, and see that their earliest settlements were made inside the level plain perennially under water, where well-

protected dykes kept out the floods which are there never more than 3 feet above ground-level; and where, free from wild beasts and desert Arabs, they could build their cities and temples and cultivate their lands, which could be irrigated by free flow through openings in the dykes. It was in the marshes surrounding their settlements that they encountered the giant brood of Tiamat mentioned in the first tablet of creation. Sharks from the Persian gulf travel up the Tigris to Samarra, north of Baghdad, and must have been then, as now, a terror to bathers. The beasts described as raging hounds and rams in the translations may have been lions and wild boars, of which the former were common in Lower Babylonia before the Arabs possessed firearms, and the latter are still exceeding numerous. It is no unreasoning tradition which places the Garden of Eden of Sumer and Akkad, the city of Eridu and its temple E-Sagil, at Kurna, the late point of junction of the Tigris and Euphrates; though I cannot but think that it will eventually be found just north of Ur at the ancient junction of the two rivers. As the Persian gulf has a 10-foot tide, the flowing backwards and forwards of the waters of the rivers past Eridu may have given some over-enthusiastic Sumerian the idea that Sumer was above Akkad, and led to some confusing statements.

> "In Eridu a dark vine grew, planted in a beautiful place,
> To the glorious bower its shadow extends,
> No man enters its midst.
> Within are the sun god and the beautiful god of the east,
> Embraced by the rivers where the two waters meet."

To-day, on the lower Euphrates, you see in the best reclaimed enclosures wide stretches of clover, out of which rise closely planted date-palms sheltering the ground from the excessive cold of winter and the parching heat of summer. From date palm to date palm are festooned luxuriant vines, from which hang rich clusters of purple grapes. Here we have the dark vine of Eridu planted in a delightful place, and the paradise of Sumer and Akkad. In this very region the Arab conquerors of the seventh century placed one of their four earthly paradises; Damascus, Shiraz, and Samarkhand being the other three. The trees of life were there sheltering the garden; and the forbidden fruit of the vine, the nectar of the gods, but indulged in by curious Eve to her undoing.

As years rolled on, the banks of the Kushite or old Kutha branch of the Euphrates, on which Eridu was situated, rose higher and higher owing to the silt-laden waters of the river; and eventually, on the occasion of some very high flood, the river left its channel in its upper reaches and flowed down one of the wide depressions of the delta. Kutha and the upper cities were left high and dry, and had to depend on silt-cleared canals for water, while Eridu and the lower cities were inundated. The Euphrates, however, was again traversing wide marshes, and the foundations of new cities and new temples were laid behind well-protected banks situated within the new flooded area. To the temple of Marduk or

Nimrod at Babylon was transferred the name of E-Sâgil, the venerated shrine of the cradle of the race of Sumer and Akkad.

"And Kush begat Nimrod, the beginning of whose kingdom was Babylon."

In like manner to-day, as one goes down the Hindie branch of the Euphrates or the Pallacopas, which has practically taken the place of the old Babylon branch, one sees the Arabs everywhere erecting cairns to commemorate the spots where Ali's camel stopped or Hussein dismounted. When the Babylon branch is completely dry, all the shrines which now stand on its banks will find themselves located on the Hindie branch, just as E-Sâgil moved from Eridu to Babylon. Eridu, in its evil day, had to content itself with the temple E-Apsu. Its doom was sealed.

When taking the names of the ancient gods and shrines of Babylonia, I have tried to pronounce the words as I think the marsh Arabs would pronounce them. The letter "E" which precedes the names of the shrines is undoubtedly the same as the "Yeh," which every Arab uses when he takes one of the ninety-nine names of the Almighty: "Yeh Sâtir," "Yeh Karîm," etc. The god Ea becomes Yehya, an Arab name in use to-day. The word "Tiamat" becomes Têh-a mat, with the final "t" pronounced only on occasions. When a tribe of marsh Arabs is going to attack another tribe, the warriors form themselves into rings of from twenty-five to forty men, and run round and round, holding up their guns, stamping the ground, and shouting, as far as I could make, out "Têh-um," "Têh-um," with the first syllable hissed out very emphatically. On such occasions the warriors wear no clothing beyond a fold of cloth round the loins; and I once saw the wife of the principal sheikh, very lightly clad herself, run from group to group, pat the men on their backs, and urge them to the combat. She was so excited, she forgot that her husband's brother was a Turkish pasha. In Babylonia an expression like the Egyptian "Il kelb il kebir" becomes "Il cheleb il chebîr," and Marduk would be pronounced Maruduch.

We are all agreed that the Semites moved down the Euphrates from the north-west, but the location of the original home of Sumer and Akkad is not so easy. Living in Baghdad and its surrounding deserts for three years, studying these questions and pondering over them, I have formed opinions on them, but my reading is not sufficiently deep to tell me whether I am not re-stating what others have stated before. When working at these problems, I tried to persuade the Rev. Prof. Sayce to come and study the question on the spot, but Karkemish on the upper Euphrates had superior attractions; while Miss Lowthian Bell could not be persuaded to abandon her researches into the comparative architectures of Ákheider and Kasr Sherin.

When human beings first appeared on the earth, and for many a generation afterwards, men could only have just held their own against wild animals, and, while their dwelling-places were surrounded by forests and

jungles, the unending struggle must have left them but little time to make any real advance in civilization. It was far different in the oases of Arabia and practical oases like Anah and Hit on the upper Euphrates. Here it was possible for men to destroy the existing wild beasts, and as their numbers could not be recruited out of the deserts, they were exterminated; and men had leisure to become gradually civilized. "Amalek was the first of the nations" was spoken, with knowledge, of the Arabs stretching from the delta of the Nile to the upper Euphrates. Living in tents and using gourds for vessels, they have left no traces such as we see in Egypt and Babylonia; but Arabia has been able to pour forth from her parched loins her virile sons who began the subjugation of both the Nile valley and the valley of the Euphrates. Everything in Egypt was easy and to hand; the Nile was and is the most stately and majestic of rivers, and, carrying a moderate amount of deposit, creates no serious difficulties for the dwellers on its banks; the Garden of the Lord, the land of Egypt, is very fertile; and the climate is mild in winter and never parches in summer. Egypt, therefore, produced no world ideas. None of her sons were possessed of a fine frenzy, with eyes glancing from heaven to earth and earth to heaven. It was far different with Babylonia. The Tigris and Euphrates in flood are raging torrents, and their ungoverned and turbid waters need curbing with no ordinary bridle. Babylonia's soil is very fertile, but the winters are severe indeed and the summers savage and prolonged. The range of temperature is between 20° and 120° in the shade. Brought up in a hard school they possessed virile intellects. Moses' first contact with Babylonian beliefs and creations, in the house of the priest of Midian on the slopes of Horeb, entranced him; in the burning bush of the deserts he saw the footsteps of the Almighty, while heavenly voices spoke to him out of the storms raging on the summit of Sinai. In connection with this we must remember that Moses' wife is called, in one place, a daughter of the priest of Midian, and in another a Cushite or Babylonian woman. Her father was probably a learned Babylonian exercising priestly functions among the Arabs.

The extraordinary dry heat of the summer, by day and by night, gives a lustre to the stars, a distinctness to the constellations, and a glow to the fields of powdered stars (called here the milky way) which cannot be conceived by one who has not spent the whole summer in the plains of Shinar. The sons of Sumer and Akkad were the first astronomers and thinkers of the world. They divided the year into months, the months into weeks, and the weeks into days, on a system which lasted to the days of Julius Cæsar. They created the sabbath day, peopled heaven with Cherubim and Seraphim, and they first saw Orion leading out the starry hosts of heaven. Perennial irrigation was their creation, and that in the face of floods such as the Tigris and Euphrates bring down. By their skill they introduced wheat on the Earth, but in the domain of abstract thought they were especially predominant. In evolution they out-Darwined Darwin.

Seeing the delta of the rivers which had been at the mercy of the high floods, gradually reclaimed, and steady progress on every side of them, they cast their thoughts back and saw as the beginning and origin of everything, infinite chaos represented by the devastating spirit of the floods of the river mingling with the wasteful spirit of the sea, and producing monstrous births; but less monstrous than themselves. Tiamat, through her union with Apsu, gave birth to Lakhmu and Lakhamu, and ages increased, and Ansar and Kisar were born, and long were the days, and the indifferent gods came into existence, and long intervals of time elapsed, and the good gods were evolved, each better than those who gave them birth, until finally Marduk appeared, the greatest and most beneficent of all.

Darwin has stated that man bore about his body the indelible traces of his lowly origin; but these people had been very bold—they had said that everything in heaven and earth and under the earth bore witness to its lowly origin.

Apsu, the flowing and ebbing but limitable sea, appeals to Tiamat, the illimitable and ever-moving flood, to help him to overthrow the beneficent works of Marduk, who was so ordering the worlds that such rest as even he, Chaos, took, was banished from him. So opens the Epic of Creation which describes how Ea and the older gods mastered Apsu and the marshes, but it was Marduk, the last born of the gods, who entrapped Tiamat or Rahab with a network of canals and dykes, and clove her into two pieces; and the rains from heaven above and the floods on earth below were both controlled by her split body stretched from pole to pole. Marduk, known as Nimrod by the Arabs, was the typical sportsman of the Arab world. To the Sumerians he was the arch engineer. So completely had the poetic ideas of Babylonia taken possession of the world, that one of the Psalms represents Rahab as being cut into pieces and given as meat to the people in the wilderness. Day was more glorious than night, and consequently evolved out of it, and therefore the evening and the morning were the first day. They found reasons why man, who was created after the good gods were developed, was yet inferior to them. In their poems they give living pictures of the floods which overwhelmed the generation of the man of Surippak on the Euphrates, the prototype of Noah. With the same courage that they faced the floods of their two torrential rivers, they faced every problem of life which presented itself to them.

Now, where was the original home of these interesting people, to whom we all owe so much? For reasons already given, it must have been in some country of oases surrounded by deserts, and Arabia is such a country, and at their very doors. The oases of Arabia are close at hand to both the Nile and the Euphrates, and the natural overflow of the surplus population would be Egypt and Babylonia. According to Dr. Pinches, in the written language of Sumer and Akkad there is only one sign for "mountain" and "country." So in Arabia to-day there is but one word for "mountain" and "unirrigated plain," the word "jebel," which is

always applied to the desert. The Arabs have special words like "barga" and "sahara" for the desert, but they always use "jebel." The oldest town in Babylonia after Eridu was Niffur, whose temple was named "E. Kura," or "Yeh jebel," or the desert. The Sumerians had no sign for "river" and there are no rivers in Arabia. It is curious that, although the children of Sumer always represented themselves as clean shaven, they represented their gods and deified heroes as full bearded, like the desert Arabs. Their ancestors doubtless entered the valley as a bearded race, and in their new damp homes shaved themselves clean for hygienic reasons. Again, according to Dr. Pinches, the Sumerians represented themselves as a tall and slight race, as would become the early generations of those descended from the Bedawin.

The Arabs of to-day are descendants of the Semites who overflowed into the desert oases from the north, and overcame the ancestors of Sumer and Akkad. Still they mingled their blood, drank in the spirit of the deserts, and became the children of the soil. In the delta of the Tigris and Euphrates to-day, with the uncontrolled floods of the rivers and irrigation without any system, the present inhabitants must have many characteristics of the first people who strayed into the plain of Shinar, and who were probably forced to take to agriculture by stress of numbers. The Emir Khazzal of Mohammera stated the simple truth when he told me that the Arabs were pleased to see irrigation engineers, not because they looked forward to agricultural pursuits, but because the land could no longer support them as shepherds. As of old, these people are genuinely fond of all religious questions and discussions. In the time of the Khalifs the population of the delta was Sunni; to-day it is almost entirely Shia. Travelling among the Arabs who live on the borderland of the two faiths, I soon learnt why it was very difficult for part of a tribe to be Sunni and part Shia. The Arabs spent the whole of their time arguing with each other in the most violent and wearying manner. Sitting among them once for some three hours, I was wearied to death with their unending war of words, when suddenly the sheikh turned to me and said, "Here is a stranger who understands us, let him decide which side is right." Out of temper with them, I said, "You are both wrong." Immediately a dozen young men jumped up, and, gesticulating in the Arab manner, insisted on my explaining my religion. I at once said, "Allah abûna, Sayedna Isa akhûna." The sheikh, in his own high-bred manner, walked across the tent, laid his hands on my shoulders, and rewarded my rudeness by saying, "Sir, you have a very beautiful religion." The party then broke up, and the sheikh said to me, "We have hitherto professed that man's religion, Sunniism, but we shall soon all profess that woman's religion, Shiaism. All day long my tribe argue with me and worry me, and when I retire to rest my wife begins." I used once to wonder why every single Arab became a Moslem; the majority worried the minority into believing.

One day I was riding with a young Englishman, who, in Oriental language, was a goodly man and well favoured, and we had as our companion the sheikh of a powerful tribe. Suddenly the sheikh turned to my companion and said, "Sir, are you married?" He said, "No." The sheikh continued, "Will you marry my daughter? She is young and handsome, and will make you a good and faithful wife." Her father was certainly a fine-looking Arab. My friend being utterly taken aback, I said, "Sheikh, how can he marry your daughter? She is a Moslem, and he is a Christian." He promptly replied, "A woman has no religion beyond what her husband has. You are people of the book, we are people of the book—nothing hinders." I have often thought he would have acted wisely in marrying the girl, for Arab women make good wives.

Late one night I arrived at a Bedawin camp, and went straight to the sheikh's tent. On my telling him I was an Englishman, he said he was pleased, as he loved their ways. I asked him which were the ways he liked. He put his hand on a big pile of Arabic newspapers by his side, and asked me if I could read the name. I told him that it was the *Mowayad* newspaper of Cairo. He said, "Yes; I can't read, but a man in the tribe can, and he explains them to us. Here is a newspaper published in Cairo occupied by English troops; the paper fills its pages with abuse of the English, and they allow it to be printed and circulated. If a Mesopotamian editor treated the Turks in this way, he would spend the rest of his life in prison. Why do not you English come over and teach us freedom?" "No use, sheikh," I said. "Why, we have been in Egypt under thirty years, and from one end of the country to the other they all wish us out. In twenty years you would be tired of us, and try to get rid of us." The old man stroked his beard, and said, "Yes; are we not all sons of Adam? He thought he could improve on paradise." Mind, the man could neither read nor write. I found him much more original in every way than any of his countrymen who could read. It is certainly a fact that in ninety-nine cases out of a hundred book-learning deprives people of originality.

While travelling among these people, I take a mule or camel laden with oranges, boxes of dates, Turkish delight, and sweets for the families of the Arabs who show me hospitality. I tell the sheikh that the rules of his country insist on his giving me shelter, and the rules of my country insist on my sending something to his children and family. Some of the children of the family are called up, and, with their laps full of fruit and sweets, they run round to their side of the tent. Between the men's and women's sides of the tent there is nothing but a suspended reed mat, and it is easy to see why the Arabs lead such healthy and sane lives. Deception is out of the question. Leaning against the mat and retailing information to the men, of the great world outside Arabistan, I can every now and then hear the women's expressions of surprise and pleasure. Long may the Arabs keep to their simple and natural life in their native deserts and conserve a type of manhood and womanhood which does credit to the

world. Few people could say as I have heard these people say, that they knew of no illness except the illness of death.

Every part of the Euphrates delta, from Hit to the Persian gulf, has at some time or another been called "Eden," the irrigated and cultivated plain, as distinct from "Kura," the unirrigable hill or plain. So in Egypt to-day the "reef" is the irrigated plain, and everything else is the "jebel," the desert where there is no rain and hill or mountain where there is rain. Soil and climate are eminently suited to fruit gardening. From date palms and oranges to peaches and plums every fruit tree is at home. The date palm is really the indigenous tree of the country. "Put its feet in water and its head in hell and it will do all the rest" is the saying of the people.

Every engineer beginning work in the delta for a canal or railway must always keep before him the memory of Noah's flood.

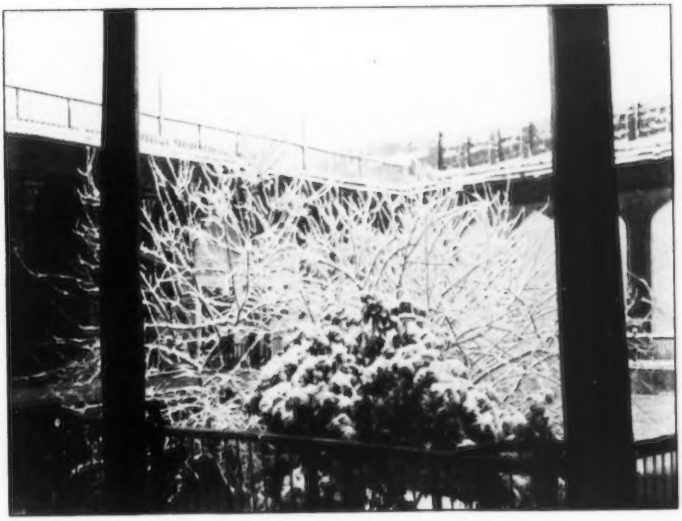
"The appointed time came near,
In the evening the gods sent heavy rain.
The dawning of that day I feared,
I feared to behold that day,
I entered the ark and closed the door.
The storm raged high,
Over the deserts the water prevailed,
No man beheld his fellow.
Istar cried like a woman in travail,
Cried with loud wail the queen of the gods:
'The former race is turned to clay.'
Six days raged the storm, on the seventh it ceased;
Like palings before me the marsh reeds appeared;
I noted the region, the shore of the sea;
Twelve measures of water covered the land.
To the desert of Nisir the ark made its way;
The desert of Nisir would not let it pass."

One has only to see the old Babylonian banks, never less than 100 feet wide, to understand that the gods of the earth were helpless against the dragon of the Euphrates. The gods of the highest heaven had to be invoked. If Babylonia is to be thoroughly reclaimed without the aid of tens of thousands of hard-worked captives, weeping by its waters, the Euphrates certainly, and, if possible, the Tigris, must be provided with escapes into the deserts in a more effective manner than the ancients could accomplish. Heavy rain in April with a warm south wind melting the snows on the Persian and Armenian hills, brings down such extraordinarily heavy floods that the channels cannot possibly contain them. The ancients controlled the Euphrates by an escape into a wide depression in the deserts north-west of Kerbela. This depression is 500 square miles in extent and 20 feet deep, and capable of holding half the dangerously high flood of the Euphrates and so mastering it. While studying the question of the Wadi Rayan escape for the Nile and the location of the ancient Lake Moeris, I was surprised to find one day on the slopes of the desert a thick belt of Nile shells. I had the level taken and found it to be 22½ metres above

sea-level. Engineers were sent east and west and north and south to find these shells and their level. They were met everywhere at 22½ metres above sea-level. These were the limits of the ancient Lake Moeris. In despair for the proper irrigation of the Euphrates delta, unless we could find an escape for this torrential river, I searched for a depression and was rewarded one day by finding a thick belt of Euphrates shells away in the deserts. Parties of engineers began levelling in every direction and the shells were found everywhere at a level of 25 metres above sea. Here was the escape, and maybe the reservoir of the Babylonians, mentioned by many writers. The Habbania escape, under construction by Sir John Jackson & Co., has been designed to carry the excess waters of the Euphrates into this depression. The hills are formed principally of salted marl overlaid by gypsum, and as the fall from the Euphrates into the depression is 90 feet, there should be, in the future, complete control of the floods of the river. The Euphrates can be mastered; there remains the Tigris.

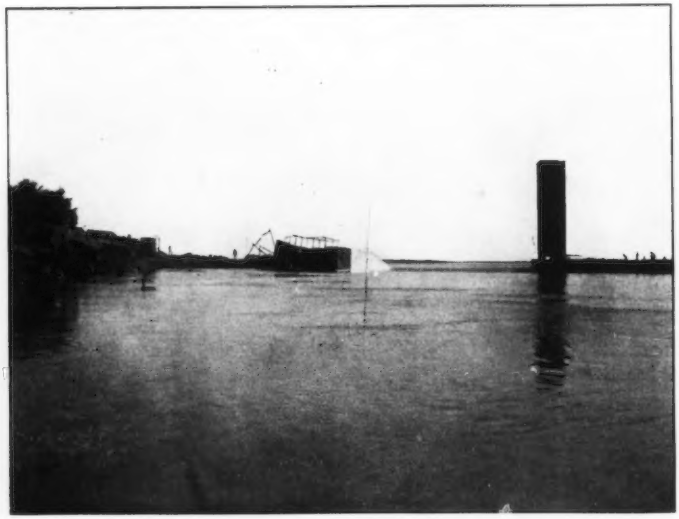
The ancients never completely mastered the Tigris, and there were occasional inundations, when, according to Arab historians, hundreds of engineers and subordinates were sacrificed. In the project submitted to the Turkish Government I have proposed a very massive canal and dyke along the right bank of the Tigris in imitation of the Babylonian works, and the sacrificing of the left bank of the river to the floods. But this is not final, as I have said in my report. We have found that that strange river, the Tarthar, which comes down from the Sinjar hills and runs between the Tigris and the Euphrates, terminates in a salt pan in the deserts south-west of Samarra. The bottom of the pan is 4 metres below sea-level, and as the Tigris in flood near the site of Nimrod's ruined dam is 56 metres above the sea, the total fall from the river is 200 feet. My engineers would have sacrificed much to level up the Tarthar and fix the contents of the reservoir, but unfortunately the salt pan is debatable ground between the Shammar and Dillem Arabs, and they could not fall into accord to let us complete our work. The Shammar were the only Arabs in the country who prevented us from working. As a rule the Arabs helped us and some were even anxious to have copies of our plans. One of them had the temerity to say that he had the same tastes as the great Arabian prophet, and being consequently fond of women, scents, and geography, he would help us to complete our work. The Shammar, unfortunately had different tastes. The construction of an escape into the depression would mean much to Babylonia, and I have therefore devoted much time to thinking out the kind of work needed to raise the level of the Tigris in flood by 8 metres and lead off the excess waters into the Tarthar depression. Two barrages on the Tigris would cost £2,000,000, and a canal capable of carrying 2500 cubic metres per second would cost some £4,000,000. These two works would cost between them £6,000,000; and, with the Euphrates escape, would by themselves double

RAHALIA OASIS. FRESH-WATER SPRING.



SNOW IN BAGHDAD.

BREACH IN THE OLD HINDIE BARRAGE ON THE EUPHRATES.



OLD HINDIE BARRAGE. FALLING TOWERS FOR CLOSING BREACH.

the value of every acre of land in the delta; be a godsend to Baghdad and every other town and village; and allow the Baghdad railway to traverse the cultivated land, and not, as at present proposed, cling to the deserts as Noah did to his ark. The engineers who aligned the railway have shown a timidity which would have cost them their lives in the times of that arch-engineer Marduk or Nimrod. They have fled from Tiamat.

Once the Euphrates and Tigris floods are controlled, the irrigation works will present no great difficulties, and the delta of the two rivers will be richer than the delta of the Nile, and a safer place to invest capital in. The great Mehemet Ali proposed to the Sultan of his day to exchange Egypt for Babylonia; and, as the Egyptians are so eager to return to the protection of Turkey, England would make no bad financial bargain if she were to exchange Egypt for Babylonia.

The chemical constituents of the soil are all that an agriculturist could desire. The Sudan Government has been recently analyzing the soils of the Sudan Gezireh, and I am enabled to give in a comparative table the relative values of the soils of the Sudan, Egypt, and Babylonia.

Locality.	Per 10,000 parts.			
	Nitrogen.	Phosphates.	Potash.	Lime.
Sudan	3	12	60	400
Egypt	10	20	60	300
Babylonia	12	24	60	1500

Looking at these figures we see that Maimûn, the son of Harûn-el-Rashid, had some slight justification for the words he uttered on the summit of the Mokattam hill as he overlooked the delta of the Nile, "Cursed be Pharaoh, who said in his pride, 'Am I not Pharaoh, King of Egypt?' Had he seen Babylonia he would have said it in humility."

The dawn of the day which sees the floods of the two rivers controlled will be comparable to the day on which Noah beheld the rainbow after the flood and saw in it a sign of divine repentance; or when Istar, after the Deluge, suspends in her hands the jewels from about her neck, and, as they hang in crescent form, swears to protect the race of men:—

> "These days, by the jewels about my neck, I shall not forget.
> Upon these days shall I think, I shall never forget
> That my people were given to destruction."

The first direct irrigation works to be carried out will be the Feluja and Hindie barrages on the Euphrates, and the canals and drains dependent on them. The first work will be at the site of the battle of Cunaxa, and, if I had thought of it sooner, I should have called it the Cunaxa barrage, as the ruins of Cunaxa are up against the work. The other barrage will be built on a far more interesting site. The first public work Alexander the

Great undertook in Babylonia was the construction of a new head through solid ground for the Hindie branch or the Pallacopas. Its head had hitherto been in sandy soil, and as the branch had to be opened annually in flood to escape the excess waters of the Euphrates, and then closed after the flood to keep the Babylon channel full of water, the annual closure had been a work of extraordinary difficulty, entailing the presence of 10,000 men. Next to building a masonry barrage it was the wisest thing he could have done. And till to-day, the Hindie branch at its head traverses some of the hardest soil of the delta, and it is possibly owing to the wisdom of Alexander's choice that the barrage holds its own in the way it does. No sooner had Alexander fixed the site of the head of the Pallacopas than he turned to the drainage of the country. Here was the true irrigation engineer.

On the Tigris, the canals to irrigate the country north-west of Baghdad will be taken off above the proposed barrages near Nimrod's dam. Once these barrages are finished, the canals and drains will be very easy and the works remunerative. This spot on the Tigris is full of interest.

The Tigris enters its delta at Beled, south of Samarra, where were situated the famous weirs of antiquity, which, judging from the bed-level of the El-Gaim head of the Nahrwân, must have held up the water of the Tigris to a height of 10 metres. In this reach of the Tigris, under the surface alluvium, lies a 10-metre belt of very compact conglomerate which again overlies a stratum of clay. This bed of conglomerate dips to the south-east and disappears under the bed of the river east of Beled. Formerly the Tigris rolled its waters above this hard conglomerate and entered the delta at a high level. The undermining of the conglomerate began in historic times, and the serious consequences to the country moved some giant of antiquity to construct an earthen dam across the channel and turn the waters over the hard conglomerate on the right bank of the river. In this new channel the river flowed for many years and, indeed, through historic times. The site is known locally as Nimrod's dam to-day. From upstream of the work were taken the two lower heads of the great Nahrwân canal. In the troublous days which followed the devastations of Halaku, everything in the country went to ruin, and either the earthen dam was swept away by the floods of the Tigris, or the undermining of the rock on the Tigris diversion reached the dam and annihilated it.

The terminal line of the conglomerate, as it was gradually undermined, must have been a cataract 10 metres high, and it was this which Tavernier saw in his travels. He has often been accused of gross exaggeration, as there is no sign of a cataract to-day, but he simply stated what he saw. Similarly, in antiquity, the Assuan cataract may have been a real cataract with a thundering roar of water.

Commander Felix Jones, of the Indian navy, who was in command of the gunboat which lies before the British Residency at Baghdad, and who was the first to describe these works, well observes—

"The summit of Opis, as we gaze around, affords a picture of wreck which could scarcely be conceived, if it were not spread at the feet of the beholder. Close to us are the dismembered walls of the great city, and many other mounds of adjacent edifices, spread like islands over the vast plain, which is as bare of vegetation as a snow tract, and smooth and glass-like as a calm sea. This appearance of the country denotes that some sudden and overwhelming mass of water must have prostrated everything in its way; while the Tigris, as it anciently flowed, is seen to have left its channel, and to have taken its present course through the most flourishing portion of the district, severing in its mad career the neck of the great Nahrwân artery, and spreading devastation over the whole district around. Towns, villages, and canals; men, animals, and cultivation must thus have been engulfed in a moment; but the immediate loss was doubtless small, compared with the misery and gloom which followed. The whole region, for a space of 250 miles averaging about 20 in breadth, was dependent on the conduit for water, and contained a population so dense, if we may judge from the ruins and great works traversing it in its whole extent, that no spot in the globe, perhaps, could excel it. Of those who were spared to witness the sad effects of the disaster, thousands, perhaps millions, had to fly to the banks of the Tigris for immediate preservation of life, as the region at once became a desert, where before were animation and prosperity. The ruin of the Nahrwân is the great blow the country has received. Its severity must have created universal stupor, and was doubtless followed by pestilence and famine of unmitigated rigour."

Before any work is undertaken for the regulation of the Tigris or raising its flood surface, borings should be taken from upstream of the site of Nimrod's dam in a southerly direction, to see if it may not be possible to imitate the action of the old Babylonian engineers and turn the Tigris again over the conglomerate. If such action could be taken there would be an economy of over £1,000,000; but the new channel of the Tigris would flow through Lake Akkar-Kuf and join the existing channel of the river near the iron bridge on the Kerbela road south of Baghdad. This is noted on drawing No. 80 of my book, 'The Irrigation of Mesopotamia,' published by Messrs. E. & F. N. Spon, of 57, Haymarket. I have also noted on drawing No. 2, that when the delta is developed, the Tigris escape should be carried out, even if it entails sending the Tigris water through the salt pan and across the Euphrates, on the level, down the Habbania escape. This extreme measure will not, however, I think, be necessary.

The second barrage on the Tigris will be made at Kut, so as to enable the Hai branch of the Tigris to be converted into a perennial canal. The Hai branch is the Tigris of Babylonian, Persian, and Arab times, and traverses very rich lands. On its banks are the ruins of Wasit, one of the three early capitals of the Khalifs; and a little lower downstream, Tel Lo, the Lagash of the Sumerians, a very ancient town of the delta.

Further down the delta and at the junction of the two rivers, regulating works, dykes, and canals are proposed to reclaim the rich delta of the ancient Karun river, from Busra to the Khor Abdalla. In ancient days, when the joint waters of the Euphrates and Tigris entered the Persian gulf by the western head of the Khor Abdalla and the Karun by the eastern head, the muddy waters of the Karun swept over these lands and laid down this deposit. The Karun, unlike the Tigris and Euphrates, traverses no swamps, but comes straight down from the Persian hills at a high velocity and carries its muddy water into the sea, and is capable to-day, as it was in the past, of forming such a delta. It is owing to the high land formed by this delta that the swamps of the Tigris, Euphrates, and Kerkha rivers are all fresh-water swamps and totally unlike the salt-water lakes of Egypt. These fresh-water lakes are potent with future wealth. To-day great herds of buffaloes are fed in them, and they are moreover full of wild boar. The Kerkha river which flows into the Tigris downstream of Gurna is the ancient Choaspes, on whose banks are the ruins of Susa or Shushan, the residence of the kings of Persia, and the prison of all the kings conquered by the Persians. It was on this account probably that it was known in ancient times as "the stream out of which none but kings do drink." It was here that M. de Morgan found the tablets containing the laws of Khummurabi, the best known king of early Babylonian days. The tablets were doubtless taken there from Babylon by Cyrus or one of his successors.

Both the Kerkha and the Karun have ruins of ancient dams built across them for purposes of irrigation. It is extraordinary how capable an Arab is of turning a country into a desert. Outside of his own desert home he begins by being little else than a human locust. As the Euphrates, Tigris, and Kerkha bring practically no deposit into the Shatt el Arab, this latter river carries only Karun mud, and it is in consequence of this that the bar at the mouth of the river is not nearly so serious as it would otherwise be. To deepen the channel across the bar and to keep it clear would be a work of no great difficulty.

The Adhaim river, which flows into the Tigris at the site of the ruins of Opis north of Baghdad, is fed by considerable swamps and marshes north of the Hamrin hills. At the point where it emerges from the hills are the ruins of a massive dam, from upstream of which were led off two canals to irrigate the level plains on both sides of the river. These works could be easily reconstructed when the more important works in the delta were undertaken.

Downstream of Baghdad the Tigris is joined by the Diala river, the ancient Gyndes. Of this river, Herodotus records that the favourite horse of Cyrus was drowned in its waters, and that, in consequence, he employed his army in digging thirty canals, among which the waters of the river were divided and made incapable of ever drowning a horse again. Xerxes might have so employed his army, but Cyrus was cast in a different mould.

One of the canals to-day bears the name of Khorassan canal, and was probably dug by the Khorassan contingent of troops. In examining the project for the reconstruction of the Nahrwân canal which was led into and out of the Dyala, it was evident that whatever motive Cyrus may have professed for the action he took, the mastering of the waters of the Dyala was the only solution of the problem. Every other solution seemed to me so difficult that I asked the opinion of Sir John Benton, the able head of the Irrigation Department in India at the time, and he wrote back that he considered that Cyrus' engineers had solved the problem in the best way in which it could be solved.

The Beled Ruz, Khalis, Khorassan, and Mahrût canals utilize all the perennial waters of the Diala to-day, and irrigate a very large area of country and many beautiful gardens. The flood waters of the river are, however, quite ungovernable. I have proposed the construction of an earthen dam across the Diala, a little downstream of the point where it issues from the Hamrin hills, and the diversion of the river down the El Mardj depression, after the example of Cyrus. With the Diala thus controlled, it will be possible to feed the existing canals, and to carry down the Diala itself, only as large a supply as the lower Nahrwân can take. A second earthen dam across the Diala downstream of the Nahrwân head, similar to the one constructed by Cyrus' engineers, will suffice to turn this restricted supply down the canal. When this proposed diversion is carried out, not only will the delta of the Tigris from Baghdad southwards be greatly relieved in flood, but the waters of the Diala, spreading over the gently sloping and wide Khôr Merj and Khôr Seveki, will create a new delta of great value.

After the question of flood protection, the most important matter in the delta is that of silt prevention. The two rivers in flood carry five times as much deposit as the Nile. It was an old saying in India that when an irrigation engineer died, the letters "SILT" were found engraven on his heart. In late years the Punjab engineers have lifted the question on to a much higher plane, and with their aid and my own observations, I have been enabled to design works which will, I trust, even master the Euphrates in its muddiest moods. The ancient Babylonians, not having barrages, had to locate their canal-heads in the deep cutting reaches of the river, and turn them into veritable silt traps. With barrages we shall be able to take the main canals out of trained reaches of slack water, free of the coarse silt which is incorrigible. By imitating nature and aligning the canals just like all natural branches of the rivers which do not silt; by closing the main canals when very muddy freshets come down; by taking those of them which have little slope through wide depressions; and by freely using escapes, we shall lay our hand on even the silt of the Euphrates. And in order that the fields may not lose the rich muddy waters of the floods, the minor canals will have flood heads on the rivers, traverse the main canals by syphons, and course down the steep transverse

slopes of the country, carrying the deposit with them. In low supply the minor canals will be fed by subsidiary heads on the main canals. Perennial irrigation will thus be secured It is interesting to note that the steep transverse slopes of the Mesopotamian rivers impressed the prophet Ezekiel, who was long a captive in Babylonia. His slope of one in a thousand has been found accurate by my engineers again and again. "And when the man measured a thousand cubits the waters were to the ankles. Again he measured a thousand, and the waters were to the knees. Again he measured a thousand, the waters were to the loins. Afterwards he measured a thousand, and the waters were waters to swim in, that could not be passed over."

On the subject of navigation I hold the views of nearly every engineer in Upper India. In the arid regions of the Earth water should be monopolized for irrigation, and railways for transport. You cannot leave the waters of the rivers in their channels and irrigate the country with them. For navigation you may substitute railway transport; for purposes of irrigation nothing can take the place of water. When Alexander decided to send his fleet up the Tigris, he had to cut the earthen dams thrown across the river. Just as the river was then dammed, so it will be when the delta is developed. A discharge of 10,000 cubic feet a second are needed in the Tigris to allow of navigation between Busra and Baghdad. This quantity of water could irrigate 750,000 acres of cotton worth £7,500,000.

Where the alluvium of the rivers overlies the pebbly deposits of the deserts at a convenient depth, there are strong currents of fresh water which may be in places artesian. An extended series of bores might disclose sources of supply of great value for perennial irrigation, especially for the irrigation of palm groves and fruit gardens. This study seems to me worth pursuing. I learnt the fact too late to make any use of it in my projects.

I bring this lecture to a close by expressing my genuine pleasure at being privileged to address a meeting of the Royal Geographical Society on so interesting a subject as the restoration of the Garden of Eden. By the side of Marduk, the Pontifex Maximus of the gods of Babylonia, I am but a Pontifex Minimus, still a Pontifex. And it is my firm trust that works carried out on the broad lines of the project submitted by me to the Turkish Government, provided the works themselves are executed with the expedition and liberal supervision which are their life, will secure a firm foundation for the resuscitation and future prosperity of this once famous land. Perennial irrigation with regulating works on the two rivers will be widely different from the irrigation of the ancients in the upper parts of the delta, where tens of thousands of captives laboured at the unending task of clearing silt from the waters of Babylon, by which they sat down and wept. Irrigation such as we propose, will bring us back to the happier days of the early settlements in the marshes where the waters were comparatively free from silt and where they created for

themselves gardens of Eden, whose memory has lasted so long. We shall once again realize on the banks of the Euphrates, the meaning of the affectionate address of some ancient Sumerian seer :—

> "O thou river who didst bring forth all things,
> When the great gods dug thee out,
> They set prosperity on thy banks."

The PRESIDENT (before the paper): We are about to hear a paper from the gentleman on my left—not the first time that he has honoured us in a similar fashion in this hall. Many of you will remember (I did not have the good fortune to hear it myself) the very interesting paper he read to us eighteen months ago. Since then Sir William Willcocks has been working at various problems connected with Mesopotamia, geographical, irrigational, historical, and biblical, and the results of these studies he proposes to give us to-night. I need hardly remind you, because you know already, of the extensive experience and the great reputation of Sir William Willcocks in irrigation works in India, South Africa, and Egypt, as well as in Mesopotamia. He is no doubt a great hydrographical engineer, but the paper to which we are about to listen will show that he is a good deal more.

The PRESIDENT (after the paper): We have with us to-night that great authority, Prof. Sayce, who, if I may say so, lives equally in the past and the present, and is better able than any man living to read to us the riddles of time. I hope he will consent to do so to-night.

Prof. SAYCE: It has been a great privilege to-night to listen to a masterly paper by one of the most eminent of engineers and the most experienced of irrigators. It has been an especial privilege for myself, who have been occupied most of my life in trying to solve questions connected with the earlier history of Babylonia. All history is largely dependent upon geography, but in no part of the world is that more true than in the case of Babylonia. Babylonia was the gift of the rivers, and it was made inhabitable by the irrigation works carried on in times which we now call prehistoric by the earliest engineers of the country. The Babylonian plain was called the Land of Eden by its inhabitants—Eden signifying a plain in the primitive language of Babylonia. It was in this plain that the garden was situated. It was not a garden in our sense of the term. The word signified what we should now call a plantation mainly of fruit trees. In the Old Testament it is stated that the Garden of Eden was watered, not by rain, as would have been the case in a country like Palestine, but, as it is translated in our Authorized Version, by a mist which rose from the ground. The word in the Hebrew, which is translated mist, is a word which occurs nowhere else in the Old Testament. It was borrowed from Babylonia, where it signifies first of all the inundation of the sea, and secondly, the annual inundation of the rivers. It was thus the annual flood of the Babylonian rivers which irrigated Paradise. There is one point in the paper I am inclined to criticize. We have learnt from Sir William that at present the delta of the Karun prevents the salt water of the Persian gulf from making its way into the marshes in what was originally the southern part of the Babylonian plain, not very far from the sites of the ancient Eridu and Ur. Now, I gather he would imply it was also the case in the early days of Babylonia that the marshes in the extreme south of Babylonia were protected similarly by the silt of the Karun from being contaminated by the salt water of the Persian gulf. Eridu, however, was the primitive seaport of Babylonia. It was built upon a horn of the sea, and in an early Babylonian map a horn is represented running up from the Persian gulf. It was in Eridu that the first man lived and fished in the sea, and every day presented a dish of food to his

deity. It would seem, therefore, that whatever might be the case now, in the early days of Babylonia the sea made its way as far as Eridu and Ur, and consequently what are now the marshes in that part of Babylonia must have been a branch of the sea itself. By way of conclusion, I should like to ask Sir William what is his opinion at present regarding the identification of the rivers of Paradise? Two of them we all know, but I should like to hear what he now believes to be the representatives of the other two rivers, the Pison and the Hiddekel. Formerly, when he considered that the Garden of Eden lay more to the north he put forward certain identifications, but now that he has come over to my view in regard to its southern position, I would ask what he thinks may be the streams or the channels of streams which he would identify with the two unknown rivers of Paradise?

Sir JOHN JACKSON: I am rather afraid there is not very much I can say for the simple fact that we are only just, as it were, making a start with these great works which have been laid out by Sir William Willcocks. The early part of last year I paid a visit to Baghdad and across the desert to Babylonia and to Hindie, where we were starting the construction of the barrage. The whole country I found most interesting, and it certainly appeared to me that the result of carrying out these works, if they are carried out as Sir William Willcocks puts it, quickly and in a proper business-like way by the Turkish Government, can only result in very great commercial success. You saw those pictures this evening—you saw the unirrigated land, and then you saw the irrigated. I visited both those sites, and that is just what you see. We want to acquire all the country between those rivers, to make the whole length of it just one great productive garden. We found these Beduins very difficult to deal with. I have had to work in other parts of the world where we have also found natives difficult to deal with at first, and one almost felt a little downhearted, but by a proper system of treating them we have always been successful, and found after a very short time we have got them into proper shape, and I am very pleased to see from reports received that my chief agent is quite sanguine that before very long we shall get these natives into proper shape. When I was at Hindie I saw they had no wheelbarrows, so I ordered some, also planks for the men to use. An assistant of mine saw a Beduin working in their usual plan—filling a little spade and putting the earth into a sack, carrying it on his shoulder. My assistant said, "You had far better use this wheelbarrow; you will do more work" (he was on piecework). The man put down his little sack, raised himself erect, and said, "You people from the West, why, a thousand years ago no one knew you: my people have been here from the time of Moses, and are you trying to teach us how to carry earth?"

Mr. L. W. KING: I think every one will have been struck, in listening to the paper, with the way in which Sir William Willcocks has used the old legends of Babylonia to illustrate the difficulties encountered in that country by the modern engineer; he has, in fact, shown that the problems which confronted the old Babylonian engineers have not materially altered to day. He has told us that after flood-protection the main matter in the Euphrates delta to-day is the prevention of silt. I do not think any one who has not seen one of those old Babylonian canals, with its ancient bed standing at a high level above the surrounding plain, can quite realize the effects of such silt-deposit; and it may be of interest to mention that even as early as the year 2000 B.C. the accumulation of silt in the Babylonian canals was one of the things which caused greatest trouble to the inhabitants. Among the letters of an old Babylonian king discovered a few years ago, there are several giving directions to clear out the silt from canals which had become blocked. It was the duty of every village or town upon the banks of the main canals in Babylonia to keep its own section clear, and if the king's letter did not receive

a prompt answer by a renewal of the water-supply, there was trouble for those villages. There is one other point to which I should like to refer, and that is the geographical situation of Eden, or rather of the place which lent its name to the Garden in the Hebrew narrative. Prof. Sayce has referred to the fact that Sir William Willcocks has now adopted his theory that Eden should be set in the south of Babylonia in the neighbourhood of Eridu, and I can bring forward a piece of new evidence which rather remarkably substantiates their views. The British Museum has recently acquired a Babylonian boundary-stone which records a grant of land made by an early Babylonian king to one of his servants, and this land was situated in Eden upon the Eden canal. The existence of the Edina, or Eden-canal, has been known for some years, and Sir William Willcocks has referred to the possible use of the word Eden, that is "the cultivated plain," as a general term for the Euphrates delta. But this new stone tells us that there was a place called Eden situated on the canal; and the document is of some geographical interest, for it supplies us with information as to the more precise location of that place. In setting out the orientation of the estate, the text mentions that one side of it was bounded by the province of the sea-land, that is to say, a tract of country along the sea-coast at the head of the Persian gulf. This reference proves that the Babylonian town of Eden lay in the extreme south of Babylonia. If we like definitely to identify the Biblical Eden with its Babylonian namesake, we may accord the new boundary-stone the additional distinction of being, so far as we know, the only extant object from that site.*

Colonel F. R. Maunsell: I should like to draw attention to a few geographical points in connection with this paper. There is no doubt, I think, that the Garden of Eden was situated between the Euphrates and Tigris, above their junction where the lecturer has explained. First of all, geographically, there is the central situation on the Earth's surface of this country where the garden was situated. As regards the diffusion of the human race subsequently from it, we have heard the cities of Eridu, Ur, and Lagash were either close to or on an arm of the sea, and therefore the inhabitants of these places, or the prehistoric peoples before them, could sail towards India and the Far East, and mankind could be diffused in that direction. Or they could go towards Egypt or Syria up the Euphrates, thence towards Greece and Europe, while there were also the great land routes to the north and north-east into Central Asia. The position was therefore very central for the diffusion of the human race. I should also like to emphasize the connection between Babylonia and the land of Elam—the mountainous country which lies to the east of it. I think there must have been some connection from the very earliest times, as one is geographically the complement of the other. There is the hot plain of Eden between the rivers on the one side, and close to it on the east the mountain country of Elam, with running streams, upland pastures, with quite a different climate to the lowlying ground, and one towards which people would naturally migrate. I think that is an important point in considering where the Sumerians came from. I imagine they were first diffused from the Garden of Eden in the direction of the mountains of Elam, and there in a more genial and virile climate they built up great cities and the civilization of which we have heard, and subsequently returned to Sumer and Akkad, where they met the Semites coming from the north-west. I have made two journeys through Elam, the modern Pusht-i-Kuh province of south-western Persia, and was much struck by the immense number of ruins, such as

* The monument has been published by the Trustees in 'Babylonian Boundary Stones and Memorial Tablets in the British Museum,' edited by L. W. King (1912), pp. 76 ff. Its date is about B.C. 1080.

those at Zarna, Asmanabad, Hulilan, and others, still untouched, which are found in those mountains; I think they were used by people from the plain from the very earliest times; also in northern Elam there is the ancient city of Holwan, which most travellers have seen on their way into Persia by Sir-i-Pul, in which, when excavated, we may find a great deal to elucidate ancient history; and further north again the great plain of Shehrizor near Suleimanie, abundantly dotted with mounds large and small which await exploration, and will no doubt add to our knowledge of the Babylonian and early history of the country.

Sir W. WILLCOCKS replied as follows to Prof. Sayce:—

A. The four rivers into which the river of Eden of the Bible parted were: (1) the Euphrates proper, or the Babylon branch of the Euphrates; (2) the Gihon, or the Hindia branch or Pallacopas, encompassing the whole land of Cush, or ancient Babylonia; (3) the Pison, the Habbania, and Abu Dibis overflows or depressions in the desert, between Babylonia and Havilah; (4) the Hiddekel, the Sakhlawia branch of the Euphrates, carrying half the water of the Euphrates into the Tigris, being a second head to the Tigris and flowing between Babylonia and Assyria.

B. The Garden of Eden of Sumer and Akkad could be placed nowhere but at the junction of the ancient Tigris and ancient Euphrates, as the professor has always held. Into the joint stream, or the Shaät el Arab, flowed the Karum and Kerkha rivers.

C. No salt water could have entered the Tigris-Euphrates marshes. If in the Babylonian or Assyrian edition of the Sumerian epic the Deep is called salt, it must be the handiwork of some Babylonian scribe throwing what he considered light on the subject. It was quite possible for Eridu to be the port of Chaldea and yet far removed from the gulf, just as Busra is to-day the port of Irak and 60 miles up the Shaät el Arab. Some of the fresh-water fish of the Tigris and Euphrates are of enormous size. In Baghdad you see a strong mule just able to carry a single "bis."

The PRESIDENT: I dare not attempt to decide between these two great authorities, even although I have had the good fortune to visit the countries to which they both refer. But whichever of them is right, upon one point we shall all be agreed, and that is that the thanks of this meeting are due to the reader of the paper for one of the most ingenious and interesting papers to which I, at any rate, have ever listened in this hall—a paper not only showing great originality of thought and research, but composed and delivered in a style entirely his own. Indeed, I have seldom heard a more varied address. We had excursions into the history and literature of the subject, we had side lights thrown upon Arab life, character, and I may also say Arab morals. We had daring political suggestions into which I certainly shall not follow the reader, and in the background we had no small amount of sound and scientific information connected with the subject to which Sir William Willcocks has devoted the best years of his life, and with which his name will be immemorially associated. We hope very much that some time in the future the great schemes which he has worked out with so much skill may materialize to the benefit of the Arabs who inhabit that part of the country, and of the rest of the world. May I ask you to join with me in giving a hearty vote of thanks to Sir William Willcocks for his paper this evening?

NORTHERN NIGERIA.*

By CHARLES LINDSAY TEMPLE, C.M.G.

PERHAPS it is unnecessary to remind you that it has been decided to unite the two Protectorates of Northern and Southern Nigeria and the Colony of Lagos into one great Dependence of the Crown under one Governor. In the circumstances it has been considered useful to take stock of our knowledge of these great provinces; of those geographical conditions which lie at the basis of enterprise in all directions; of the teeming millions of natives of many races, of all grades of civilization, which inhabit them; and of the present and possible future of the development of those resources upon which the economic prosperity of the natives mainly depends. At the last meeting of the Society Mr. Kitson dealt very fully with Southern Nigeria.† I shall, therefore, confine my remarks to-night to Northern Nigeria, where I have had the honour of serving over ten years. I shall endeavour to explain the methods of administration which have been adopted with a view to ensuring the advancement of the native populations.

Historical Notes.—The modern history of Nigeria, as far as the European is concerned, may be taken to have commenced with the establishment in the seventeenth century of one or two trading stations at the mouth of the Niger and adjacent rivers. It was not until the beginning of the nineteenth century that organized exploration of the Niger region was undertaken. Some of the names to be remembered in connection with the exploration of these territories are Mungo Park (1797–1805), Lander, Clapperton, Barth and Allen (1820–1830), and MacGregor Laird, the pioneer of Lokoja who established himself at that place (1852). Until the Berlin Conference of 1885 recognized this region as being within the British sphere of influence, it had been the scene of a struggle for supremacy between French, German, and English trading firms. The Royal Niger Company were granted a Charter in 1886, and the following ten years were spent in building up an administrative and trading organization. Treaties were made with the principal Filane Emirs, notably that with Sokoto in the early nineties. In 1894, Sir Frederick Lugard was sent by the Niger Company to anticipate the French in making a treaty with the chiefs of Borgu. This object was accomplished just in time. In 1897, the Filane made an attempt to drive the white man from the country, and this led to an expedition against Bida, organized by Sir George Goldie, which was, for the time at any rate, completely successful. The result of these military operations enabled the company to take active measures for the extension of trade. Towards the end of 1897, consequent on French action and the "Boussa crisis," the British Government began to take

* Royal Geographical Society, May 6, 1912. Map, p. 240.

† Mr. Kitson's paper will be published in an early number of the *Journal*.

serious notice of the country, and Sir F. D. Lugard was entrusted with the organization of a local military force, now known as the West African Frontier Force. After many years of magnificent pioneer work, different in degree, perhaps, but not in kind from that of the East India Co., the Charter of the Royal Niger Co. was revoked, and the Government assumed the administration of the Niger Company's territories on January 1, 1900. The amount paid to this company from Imperial funds was approximately one million pounds. The company reserved the right of receiving one-half of any revenue obtained from mining companies by the Government over an area of about one-half of the territory for the space of ninety-nine years. Sir Frederick Lugard was appointed High Commissioner. The headquarters of the Protectorate were established at Zungeru in 1902. Zungeru was chosen because it was the most northerly place accessible by water transport, being at the limit of navigation of the then unexplored Kaduna river. It was also in touch with the Mohammedan Emirates, being on the extreme northern edge of the territory controlled at that time. The place is situated on the Kaduna, in a direct line between railhead, then at Ogbomosho, and Kano, and away from the unhealthy Niger valley. After ten years' experience it has been found to be as healthy as any station in the protectorate, excepting those on the Bauchi plateau. It was connected with a port on the Kaduna, where the river is navigable for steamers in the wet season by a light railway in 1900.

Bornu was occupied by an expeditionary force in 1902; Mr. Hewby was the first resident. Sokoto was occupied in 1903; Major Burdon was the first resident. Kano was occupied in the same year, and Dr. Cargill was the first resident. Yola was occupied in 1901.

Little opposition, on the whole, was met with on the part of the natives to the expedition. There was, however, stiff fighting in 1900, when a column, under Colonel Lowry Cole, attempted to traverse the Munshi country north of the Benue. In 1901 Captain (now General) Morland was wounded at the occupation of Yola. In 1903, though little resistance was offered at Sokoto and Kano, the Kano army resolutely attacked a small force, under Lieuts. Wright and Wells, at Kwotorkoshi. For his splendid defence Lieut. Wright was decorated with the Victoria Cross. A number of refugees from Sokoto, and discontents from various parts of the Protectorate, including the ex-Sultan of Sokoto, made a determined attempt to oppose our troops at Burmi. The Sultan of Sokoto, a large number of Filane notables, including Abubakr, ex-Emir of Bida, the man who had opposed Sir George Goldie in 1897, and the officer commanding the column, Major Marsh, lost their lives in this engagement. In 1904 severe fighting occurred in Bassa, where an expedition had been sent, under Major Merrick, to punish the natives for the murder of two officers, by name Burney and O'Riordan. In 1905 there was severe fighting at Chibbuk, in Bornu. In 1906 a Mohammedan outbreak of a serious nature took place at Satiru, near Sokoto; three officers, Messrs. Hillary, Scott, and Blackwood,

lost their lives. The natives were finally defeated and dispersed by a column operating under Major Goodwin. The Sultan of Sokoto, who is still reigning, for his loyalty and steadfastness at this time of serious stress, was made an Honorary Companion of the Order of St. Michael and St. George. The services rendered by his cousin, the present Marafa of Godabawa, on this occasion are deserving of special mention, as also those of the present Sarkin Tambawel. There have been, in addition, numerous small expeditions on many of which good work has been done, but I have not time to enumerate these now. Sir Frederick Lugard left Nigeria for Hong Kong in 1906, and was succeeded by Sir Percy Girouard in 1907. He in turn was succeeded by Sir Hesketh Bell in 1909. Sir William Wallace administered the Government in the intervals which occurred between these appointments.

Areas and Distances.—The territory of Northern Nigeria now comprises an area of about 255,000 square miles, and that of Southern Nigeria about 100,000 square miles, making a total of 355,000. From Lake Chad to the extreme western edge of the Protectorate, *i.e.* the frontier of Dahomey, is a distance of about 700 miles, from Lagos to the northern border of Sokoto is about the same distance. A circle described round Kano, with a radius of 500 miles, cuts approximately Lagos and Old Calabar.

Description of Area.—The area may be divided into three distinct zones: the southern forest belt, the hill regions in the neighbourhood of Bauchi, Zaria, and the Benue, and the northern plains. Probably 80,000 square miles are covered with forest; 14,000 square miles have an elevation of from 2000 to 6000 feet, while the northern plains, with an average altitude of about 1000 feet, extend over 150,000 square miles. The remaining 90,000 square miles lie at an altitude between the plains and hills. The point on the railway where the transition from the forest zone to the plain occurs, between Lagos and Zungeru, is well marked, and is situated a few miles south of Auyan at an altitude of about 1400 feet.

Scenery.—The scenery of Northern Nigeria may be divided into the following categories. To the north, from the neighbourhood of Lake Chad to Sokoto, there occur endless wind-swept sandy plains covered with scanty and thorny bushes, chiefly acacias. A shade tree is a rarity which one may not meet with in a three days' journey. Nevertheless, the soil produces, during the rainy season, large crops of millet, with little tilling, and no manure. To the south there is a belt of rich argillaceous loam, and here we find the population thickest. From whatever point the traveller approaches Kano he will travel for three days through country every inch of which is highly cultivated, often between lanes of cactus 15 feet in height, for the fields are hedged as in this country. South of this again occur great ranges of granite hills, often weathered into most fantastic shapes. Some of these rise to a height of 6500 feet. Between these are

found fertile valleys and elevated plateaux, where the traveller can hardly bring himself to believe that he is in a tropical country. Further south he descends into the plains of the Benue and Niger, where forests begin to appear and the air is moist and damp. The character of the strata is changed, and in place of granite peaks and turtle backs, flat-topped hills composed of sedimentary rock-sandstones and grit are found. Finally, he reaches the dense and dripping jungles of the Delta.

Fossiliferous Cretaceous limestones have been found in the bend of the Gongola at Sokoto and in Muri province. Lime burnt locally is extensively used for Government buildings.

Altitudes.—Starting from the north the following are the altitudes of the principal towns and hills—

Lake Chad	800 feet
Sokoto	754 ,,
Kano	1810 ,,
Bauchi town	2200 ,,
Bauchi plateau	4000 ,,
Shere and Maigemu peaks on Bauchi plateau	6500 ,,
Zaria	2200 ,,
Zungeru	550 ,,
Lokoja	300 ,,
Auyau	1400 ,,
Ibadan	820 ,,

Rivers.—The principal watersheds which govern the dispersion of water in the rivers and streams of the Protectorate are situated at a distance of 1300 miles from each other: one is near Falaba in the hinterland of Sierra Leone, where rises the Niger; the other is on the Bauchi plateau. On the latter rise, within a few miles of each other, streams which flow *viâ* Gombe and the Gongola to the Benue, *viâ* Katagum and the Komadugu, to Lake Chad, and *viâ* the Kaduna and Zungeru to the Niger. The Cross river which flows through the Eastern Province of Southern Nigeria rises in the Kameruns.

Though the northern plains are sometimes liable to drought, yet on the whole, the territory is well watered. The rainfall, nowhere less than 16 inches p.a., is as much as 120 inches p.a. in the delta. The volume of water passing down the Niger at Baro is probably about one and a half million cubic feet per second.

Soil.—The land is, on the whole, fertile, even in the northern portion where the soil might strike the casual observer as being too sandy and light to bear heavy crops, and to require extensive periods of rest, we find in the neighbourhood of Sokoto and Kano large populations of about half a million inhabitants living at an average of 300 per square mile, and obtaining all the food required to keep them in robust health from the soil. South of Lokoja and the Benue the staple foods are roots, chiefly the yam, and to the north cereals, chiefly Guinea corn and gero, both species of millet.

In places, especially in the neighbourhood of Kano, intensive cultivation and irrigation are frequently employed, onions, peppers, cassava, sweet potatoes, and other crops being cultivated to a large extent.

The average production of cereals, *i.e.* Guinea corn and gero, may be placed at about three-quarters of a ton per acre; that of cotton from 100 lbs. to 400 lbs. per acre. The latter quantity has been found to occur in the neighbourhood of Soba, to the east of Zaria. To give some idea of the potential wealth of these territories, I may mention that in the forest zone, which is probably 80,000 square miles in extent, the palm occurs at an average rate of about four per acre. As each palm produces kernels and oil of about the value of 5*s.* p.a., the total export from two hundred million palms might be about £25,000,000 per annum were the forests completely exploited.

Population.—The population of Northern Nigeria is about 10 millions, that is to say, 40 per square mile. That of Southern Nigeria is about 9 millions, with a density of 90 per square mile. The average density of population in both territories is, therefore, about 60 per square mile. The average density of population in British India is about 221 per square mile. The Emirate of Kano has an area of about 10,000 square miles, with a population of about 2 million. This Emirate approximates to the Indian Native State of Baroda, which has an area of 8000 square miles with a population of 2 millions.

The population of Nigeria may be divided into three distinct sections. First, starting from the north, that inhabiting the plains to the north of Zaria to the west of the Niger as far south as Ilorin, and in the neighbourhood of Yola. Here the influence of Semitic races, the Filane and the Arab, together with that of Islam, has raised the natives to a comparatively high state of civilization. The second group, consisting of those native races which came into contact with the invaders from the north, but successfully resisted them. These inhabit the middle region in the neighbourhood of Bauchi, Zaria, and the Benue, having found shelter and safety in the hills. They are known locally by the general term of "pagans;" some of these inhabiting the Bauchi plateau—for instance, the Sura are mounted. The third group inhabit the forests of the delta south of the Benue and south of Ibadan.

I have not time to give any detailed description of the innumerable races and tribes to be found in these territories, but I would note that in an area of about 25,000 square miles round Bauchi no less than sixty-four languages and dialects are spoken. I would, however, add a few remarks concerning certain sections which have exerted a considerable influence upon the history of the country during the past centuries. The people of Kano, for instance, have been subjected during the past five hundred years by the following alien native tribes. The first conquerors came from the east, from Surami, the headquarters of the Kebbawa, in the fifteenth century; they were led by a man named Kante, a rebel subject of Askia,

"the great" Sultan of Songhay. That tribe is now better known in connection with the name of Argungu, its present headquarters. Next came the Kwororafa, who probably emanated from the town now known as Marua, in German territory; these were succeeded by Kanuri invaders from Bornu. The dominion of the latter was put an end to by the general uprising of the Filane and Mohammedans, under Osman dan Fodio, at Sokoto, in the beginning of the nineteenth century. I would lay stress on these facts, as the idea generally current that the Filane broke in like wolves on the peaceful existence of the pagan sheep is wrong. The entire territory had probably been a veritable cockpit since time immemorial, until Kano and Sokoto were occupied in 1903 by an expeditionary force dispatched by Sir Frederick Lugard.

I should like to say a few words regarding three important sections of the native population—I mean the Filane, the Hausa, and the Yoruba. The Filane race is of Semitic origin. The language now spoken by the Filane has, however, no connection with Arabic, and the race has probably adopted a strange language. The original home of the Filane is unknown, but it is probably to be found in Persia, Egypt, or Arabia. The flow of emigration probably followed the northern shores of Africa, and thus came south to Futa Jallon, in the hinterland of Sierra Leone. From here an exodus to the east across Central Africa occurred, and in the middle of the sixteenth century there were probably about as many Filane in Nigeria as there are to-day living as subjects of the various pagan chiefs, such as the Sarkin Gobir, Bawa, and the Sarkin Kano, Rumfa. They were divided into two sections—the first the settled Filane, or Filanen Gidda as they are known locally; the second the nomad Filani, known locally as the Borroroje. The settled Filane had already mixed their blood with the Jolofs before emigrating, and they are daily becoming more and more mixed with the Hausas and Yorubas and other tribes amongst which they dwell. They are an intelligent and enterprising race, of fine physique, and form the ruling class to-day. The Borroroje, or "cattle Filane," has to a great extent kept his blood pure. They are small, wiry, hardy herdsmen, but have little enterprise or intelligence. They are not progressive, and their one desire is to be left alone. The majority are not Moslems.

The Filane revolt and subsequent Jehad was caused by the oppression of the pupils of a learned and pious Moslem Filane notable, by name Osman Dan Fodio. The revolt drew into its scope practically the whole of the Moslem population, Filane and others. It was a national movement on the part of the middle and poorer classes generally led by Filane. The pomp and panoply of war were on the side of the great pagan chiefs, whose armies were clad in mail and cotton armour and were to a great extent mounted. These armies were defeated by bowmen on foot clad in robes only. Persons interested in this question should read the Filane war-song quoted in Major Burdon's grammar of that language, where it is said

to the Goberawa pagan chiefs, "Those who disputed with the hare for his lay have conquered your horsemen." Though some may not agree with me, I would emphasize the importance of this lesson. African conquests by native tribes have been effected by infantry. The African does not regard the mounted soldier with such respect as he regards the footman. The Filane Empire became established in about the year 1810, with headquarters at Sokoto. It comprised, at the time of its greatest prosperity, in about the year 1820, some 120,000 square miles with a population of about 5 millions.

Divided into great fiefdoms under Emirs, such as Kano, Gando, Zaria, Bauchi, and Ilorin, it was, on the whole, well ruled for a space of fifty to sixty years. At the time of the British occupation, however, owing chiefly to the unstable character of the then ruling Emir of Sokoto, known by the nickname of Danyen Kasko—unbaked potsherd—the empire was divided against itself. Oppression and tyranny over the subject tribes, especially those in the belt between the unconquered hill tribes and the inhabitants of the plain, were rife, and little resistance was opposed to the British forces. On the contrary, in many places they were actually welcomed.

I would now turn to the race commonly known as "Hausa." The term "Hausa," I am quite convinced, should be used only with reference to the language known by that name. For many tribes, with markedly different characteristics, speak this language. For instance, the natives of Argungu, the Kebbawa, now speak the Hausa, and have never spoken any other language. The same may be said of the native of Katsena, known as the Katsenawa. Yet these are very distinct tribes. A native describing himself as a Hausa will always, when pressed or questioned, define himself also by name of a tribe. Hausa is, therefore, to-day, the name of a language, and not of a tribe. The Hausa language is spoken by practically all the tribes which came under the sway of the Filane; sometimes in addition to the tribal languages, sometimes the tribal languages have disappeared. It is necessarily spoken by all traders. It has a large vocabulary and simple grammar, and a pronunciation which can easily be recognized. It is probably the easiest African language to learn, as it is the most complete and adaptable. For these reasons, its use amongst the natives throughout the Niger territories, and, I would add, the Gold Coast, is rapidly extending. It is the *lingua franca* over two-thirds of those territories, and fifty years hence will probably have extended over the whole of them, and even beyond them.

Regarding the Yorubas. This is, after the Filane, the most striking of the races on the Niger. Formerly a great kingdom under the Alafin of Auyau, it was disintegrated partly by attacks from the north on the part of the Filane invaders, and partly by the gradual advance from the south on the part of the British forces, so that it is now to a great extent decentralized, Ibadan and Abeokuta being independent of Auyau. In

its normal condition, it is probable that the tribal organization of this section would differ little from that of the northern Emirates, such as Kano.

I will now attempt to explain very briefly the machinery of government set up by the natives themselves as it was found when the occupation was effected, and such modifications in that machinery as it has been found necessary to introduce in the interest of order and good government.

The power of the Filane hierarchy exerted from the historic, and to Muslim eyes almost sacred, town of Sokoto, was delegated by the Emir Em-Muminin, that is to say, the Commander of the Faithful, commonly known in the Hausa as Sarkin Musulmi, to the great captains who had been successful in the Jehad. These became Feudal lords and rulers over large areas and populations, and paid a portion of the taxes and tribute which they collected to the Sarkin Musulmi.

The most powerful of these was the Emir of Kano, whose territory exceeded 10,000 square miles with a population of about 2,000,000. In some cases the fiefs were of small extent, some not exceeding 200 square miles with a population of 50,000. The principal Emirates were Gwando, Kano, Bida, Illorin, Zaria, Katsena, Bauchi, and Yola. These feudal barons held their fiefs by appointment from Sokoto. In practice the succession was very generally hereditary, but that principle was not recognized in practice, and the Sarkin Musulmi retained to himself very arbitrary powers of patronage.

The Emirs subinfeudated their fiefs to a number of their more important followers, sometimes relations, sometimes successful generals, sometimes favourite slaves. These held a position similar to that of the Lord of the Manor in England in the fifteenth century. The peasantry were divided into two classes. One of farmers born free, and one of farmers who had been slaves and had been granted a certain measure of freedom known as Rinji. The first corresponded to the class known as "freemen of the Manor" and the second to that known as "serfs of the Manor." The free farmers held the lands on condition of serving as soldiers in time of war, or of paying a monetary equivalent. The serfs were expected to fight and also to do a certain amount of labour without remuneration on the Emirs' farms, the walls of the towns, and other works of public utility. On occasions of offensive or defensive war the Sarkin Musulmi counted on a general rally of Emirs from all his tributary dependents, and almost every year a great gathering of the clans took place at Sokoto. As I have stated previously, towards the end of the nineteenth century the controlling influence of Sokoto, at one time very wide reaching and efficient, had waned. Kano was in a condition approaching revolt. Bauchi was disloyal and, generally speaking, there was a tendency for the Filane empire to fall to pieces.

It was not thought for several reasons to be advisable after the occupation to rebuild the influence of Sokoto, it would have been necessary to support it

with an armed force, and each of the great feudal lords or Emirs, who had been in former times responsible to Sokoto direct, was rendered responsible to the Government. In short, the Government took towards Sokoto itself and the other Emirs the position which had formerly been occupied by the Sarkin Musulmi. Tradition and customs were thus to a great extent maintained, and the position was easily realizable and acceptable to the Muslem ruling classes.

The organization of each Emirate was then taken in hand. It was not found generally necessary to alter the machinery radically. Certain abuses, however, had crept in. They were due to a tendency of over-centralization. The sub fief holder, whom I have compared above to the Lord of the Manor, and whom I will now term the District Headman, had developed a tendency to remain at the capital of the Emirate in place of residing amongst the people for whose prosperity and contentment he was responsible. To exert his authority he was in the habit of employing messengers, generally favourite slaves, known as Jakadas. These messengers rapidly became extortionate, and to a great extent undermined the authority of the village heads and councils. It is fair to state that this abuse was less noticeable in Sokoto than in other Emirates. Another fertile cause of misgovernment was the fact that the areas granted in fief to the various holders were not in most cases contiguous, so that we found a Galadima, for instance, residing at Sokoto with perhaps two hundred towns and villages scattered all over the Emirate subject to his authority. To remedy this state of affairs a redistribution of towns and villages and lands was made amongst the district heads by which all districts were rendered homologous, coadunate, and self-contained. The district heads were compelled to take up their residences in their districts. The final units, that is to say, the villages—or in places where the population is found in scattered farm houses, the parish, were placed in charge of responsible village head or councils. Any order emanating from an Emir is now conveyed by his messenger to the district head only, and is by him transmitted to the village authorities, and it is the latter who convey the order to the individual, and who are responsible for its execution.

The great principle which underlies, I think, all sound administration, and which ensures that the obligation of the individual citizen towards the State should be actually enforced only by an authority which is in daily contact with the people themselves, and is therefore subject to the influence of local public opinion, is put into effect by the system which I have described. At the same time there is sufficient centralization at the head-quarters of each Emirate to enable the orders of the Emir, given on the advice of his European advisers, the Residents, to be rapidly conveyed to the population. In Kano or Sokoto, the most highly organized Emirates, the Emir's order will reach every responsible member of communities approaching two million in number in about ten days. Such orders refer to every subject relating to the administration, such as the collection and payment

of taxes, and the arrest of criminals. The policing of the Emirate is done entirely by police in the employ of the Emirs, known as Dogarai.

The members of the native administration were in former times paid in a somewhat haphazard manner, in fact, they often paid themselves. To remedy this the entire moiety of the rents and taxes which is granted by Government for the upkeep of the native administration is brought to account in the Emir's Treasuries, known as the Beit-el-Mal. By this, regular monthly payments are made, on a scale fixed by the Emirs and approved by the Governor, to all members of the native administration connected with headquarters, from the Emir himself down to the town scavenger, and including the judiciary. For instance, the Emir of Kano draws £400 per month, his Waziri £100 per month, the Alkali, or native judge, £50 per month. The dogarai are paid at the rate of £1 per month.

In the districts the native judges are paid at the rate of about £300 per annum. This sum is to them a large one, and is sufficient to raise them above the temptation of accepting bribes. The district headsmen are not yet paid fixed salaries, but are entitled to draw a percentage of the total rents and taxes collected in their districts, generally 25 per cent. The village heads are paid in the same manner, generally at the rate of 15 per cent. of the taxes collected by them. A district head receives from about £150 to £1000 per annum, and a village head from £2 to £15 per annum. The good effect of ensuring to a native official a regular source of income has been incalculable, and the principal Emirs, such as those of Sokoto, Bornu, and Kano, though at first somewhat shy of accepting a civil list, have now become quite enthusiastic supporters of this system. They recognize that every native who formerly held a position of responsibility, in time of peace or war, is still entrusted with work congenial to him, and which gives him an interest in life, and, therefore, keeps him interested, though he is a member of a subject race. On the other hand, the peasantry now appreciate the payment of rents and taxes on a scale which varies little from year to year, which are calculated on a basis understandable to the individual, and regarding the amount of which they have, through their village heads, a considerable voice in deciding. It may now be said at least 75 per cent. of the total population of the Muslem states is directly interested in maintaining the existing state of affairs.

I will now attempt to describe briefly the manner in which the funds necessary for the maintenance of the administration are secured. The principal source of revenue in Northern Nigeria is termed Land Revenue. This is raised by collecting a contribution from each individual annually, that is to say, by direct taxation.

The mode of collection is slightly different in each emirate, for it is based in every case on the system which we found in force. Certain general principles governing the mode of collection are, however, observed throughout the Protectorate.

The amount to be paid is decided partly by the extent of the resources

of the individual. For example, an owner pays 1*s.* 6*d.* per annum for each head of horned cattle as Jangali, 10 per cent. of grain crops are collected and paid as Zakka. Partly also by the privileges granted to the individual by the state, for instance, the size of the farm which he is permitted to occupy.

There is much to be said in favour of securing a revenue for the State by means of direct taxation, for there are two main points of contact between a Government and those governed, one is the business of the Law Courts, the other the assessment and collection of those contributions which it is obligatory on the individual to pay towards the common fund necessary for the preservation of the State.

The business of the Law Courts brings the Administration into contact with more or less discontented persons only. In practice it has been found in Northern Nigeria that granted the native judges are free from bribery and corruption they can administer justice more efficiently than European officials, even when the latter are conversant with the language of the litigants. It has fortunately been found possible to entrust this work to an increasing extent to a native judiciary which is now fairly well paid. The assessment and collection of direct taxation, on the contrary, brings every individual householder into close contact with the administration, and compels a close study of native affairs to be undertaken by all officials, native and European alike. It has therefore an educational effect on the officials, native and European, and on the population. This is specially the case where the contribution is *pro rata* to the circumstances of the individual. Poll taxes, hut taxes, and all form of contribution which are not based on circumstances, but are of universal application to rich and poor alike, have a lesser educative influence. In cases where they are substituted for *pro rata* taxes they have the effect of divorcing the official from the individual. For the mere counting of heads in a village is a mechanical operation, and requires little thought on the part of the village head, and moreover he can do this without assistance from his council. When, however, he is compelled to assess each individual according to his circumstances, he is in a far more difficult position. The individual may well argue the point, and in that case the village head is drawn to seek the support of his Council. This in effect, to a great measure, ensures fair assessments.

Excepting in certain pagan districts, where the village organization is yet in a very rudimentary condition, and where a capitation tax only can be collected, *pro rata* property taxes are in force all through the Protectorate. The contribution to be paid by the village unit is fixed by a European assessing officer; each proportion of this to be paid by the individual native is decided by the village authority. The revenue, when collected, is accounted for through the district headman to the Government, represented by the Resident in each province. A proportion, 50 per cent. in the Muslim Emirates, and from 60 per cent. to 50 per cent. in the pagan

district, is paid into the Government treasury, and the remainder into the native treasuries.

The foregoing remarks regarding the administration apply to the Filane States and Bornu, and in a great measure to the pagan communities. In the latter the same general principles apply, but the mode of application differs in so much as the existing organization found in these communities differs from that found in the states more advanced in civilization. But the difference is, I think, one of degree and not of kind. I am aware that some of my colleagues in Nigeria will dissent from this view. It is held by some that the pagan communities are so patriarchal in their form of government that no analogy can be drawn. My experience leads me to think that, without exception, the African native lives as he walks, in single file. It is necessary for his mental contentment that he should look up to a superior to himself, whom he can trust to support him in time of adversity, and that there should be others his inferiors, "who kow tow" to him, and whom he can patronize. I am inclined to think, therefore, that a system by which contributions from the lowest to the highest, *i.e.* direct taxation of a kind will be found, after diligent investigation, to exist in every native community. As, however, in the Muslim States we found a tendency towards more centralization, so in the pagan communities we find the central control and organization weak and rudimentary, and the object to be aimed at is to strengthen it. But in so doing, the main fundamental principle that the affairs of the individual relating to the State shall be regulated by persons living in close contact with him, and therefore subject to his collective public opinion, holds good. On these lines we are organizing the pagan tribes, such as the wild mounted pagans on the Bauchi plateau, and the industrious, enterprising, but somewhat recalcitrant Munshi on the Benue. I trust not without some measure of success. There have been no operations which, in the opinion of the Commandant, justified the use of the term minor military operations even, for more than two years past. The land revenue has increased from £16,000 per annum in 1904 to over £400,000 in 1911, and will probably exceed £460,000 in 1912. These two facts, taken in conjunction, are not without, I think, significance, and augur well for the future peace and prosperity of the Protectorate.

The policy adopted with regard to the education of the natives in the Government schools has been framed with the object of strengthening the bond between the native rulers and their people. What is best in native tradition and customs is fostered, and no attempt is made to force upon the pupils alien ideas, except in so far as these may be necessary to them in order to fit them for success in the altered circumstances surrounding them. It is satisfactory to be able to record that the emirs and chiefs, though at first they showed some reluctance in committing their sons and relatives to our care, have now, without exception, given the scheme the most loyal support.

The Emir of Kano has from the first taken the greatest interest in the school which has been established at Nassarawa, in the neighbourhood of his capital, where there are now about 250 pupils. These are for the most part, boys, who, in the ordinary course of events, will be entrusted, when they grow up, with administrative duties of great responsibility.

Economic. General Remarks.—The economic development of Nigeria, regarded as a whole, has been very great of late years. The returns published by the Government of Southern Nigeria show an increase in exports from £3,000,000 sterling in 1906 to £5,000,000 in 1910; and in imports from £3,000,000 in 1906 to £5,000,000 in 1910. The revenue, 7 per cent., 90 per cent. of which is collected in the form of customs duties, has increased from £1,000,000 to £2,000,000 in the last five years. It is not possible to say to what extent Northern Nigeria has contributed to these increases. The work in the Protectorate connected with administration has been so varied and onerous, and the funds available so scanty, that it has not been possible to furnish the staff necessary to obtain and record trade statistics. The figures published may be set aside as unreliable.

That the general prosperity of the people is increasing year by year is, however, evident. Large sections of the population are now clothed which years ago were stark naked. In the more prosperous parts, such as the neighbourhood of Kano, Zaria, Sokoto, and Bida, the general standard of living is high, and the use of imported cloth extending very rapidly. The latter is always a sign that the people have money to spare. For the imported cloth is not nearly so durable as that made locally. The receipts on the Baro-Kano railway, which has been open for hardly a year, already exceed an average of £6000 per month. The statistics of population are not yet very reliable, but there is an increase of children between the ages of one and seven years, which is very noticeable in the towns; also large areas uncultivated are now found to contain pioneer settlers. The cost of food is low throughout Northern Nigeria excepting at Zungeru and Lokoja. At Kano, a man, his wife, and two children can feed themselves well on 1½*d.* per diem.

Railways. Baro-Kano.—The railway constructed from Baro, a port on the Niger, situated about 467 miles from the sea, to Kano *viâ* Zaria was completed in June, 1911. The gauge is 3 feet 6 inches, the total mileage is 356 miles from Baro to Kano. The cost of construction was £3400 per mile, quite a record of cheap and at the same time efficient and rapid railway construction. The cost of maintenance is about £100,000 per annum. The receipts from public traffic, exclusive of rates paid for the transport of Government material, during the past six months exceeded £35,000.

Bauchi Light Railway.—It is, I think, evident that the money expended on this line was well invested. From Zaria a branch-line, with a gauge of 2 feet 6 inches, has been constructed, at a cost of £2000 per mile for approximately 100 miles in a south-westerly direction towards the Bauchi plateau.

Lagos Railway.—The Lagos railway has been extended *viâ* Ilorin, Jebba,

and Zungeru until it joins the Baro-Kano railway at Minna, some 40 miles east of Zungeru. Minna is situated at a distance of 250 miles from Lagos. The total receipts on this line during the year 1911 reached an amount of no less than £350,000.

We have here an indication of certain further railway developments which have been suggested. Up to the present, however, no scheme has been finally decided upon. Past experience has shown, however, that money expended in railways in these regions has invariably been well invested, and it is probable that a mileage of railways ten times as great as that already constructed would amply repay the cost of working and maintenance as well as interest on the capital expended.

Minerals.—The mining industry on the Bauchi plateau and in its neighbourhood has drawn to itself a considerable amount of attention lately.

Tin was first discovered by a group of emigrants from Bornu at a place called Liruein Kano about ninety years ago. The settlers were driven by raiding parties to abandon this locality, and they established themselves at Liruei Dalma. Here in 1902 they were found to have about ten furnaces for smelting purposes, and those were producing about fifty tons of metallic tin per annum. The cassiterite was obtained by calabashing, *i.e.* washing, in manner similar to that employed by the traditional gold prospector, from the bed of the Delimi river and the streams flowing into it in the neighbourhood of Tilde. Prospecting has now shown conclusively that cassiterite is distributed in larger or smaller quantities through alluvial gravels extending over an area of about 60 miles east and west, and 120 miles north and south. That is to say, over about 7200 square miles. The country rock is for the most part granite. The alluvials are of comparatively recent date and have no very great depth. It may easily happen, therefore, that in the parent lodes from which tin ore found in the alluvial has emanated will be discovered in the granite. The export of tin during the year ending December 31, 1911, was 1500 tons approximately valued at about £225,000. The total share capital of the various companies now interested exceeds three million pounds.

Galena and quartz reefs carrying free silver have been found in the neighbourhood of Orofu on the Benue.

Salt pans are worked by natives in the neighbourhood of Awe and Lafia Beriberi. Iron is extensively smelted all over the protectorate.

Coal has been found in large quantities at Udi, in Southern Nigeria, which is situated about 50 miles to the east of the Niger; also lignite at a spot about 15 miles from the river to the west of Asaba. With regard to cotton, the export has not yet sensibly increased. There is, however, one point to be kept in mind in this connection. About six million people have been clothing themselves, and clothing themselves very well from time immemorial, with cloth manufactured locally from cotton grown locally. A great export trade in Kano blue cloth exists. This cloth is to be found in large quantities in all the coast towns from Tripoli to

Dakar, and from Dakar to Lagos. There is, therefore, a great deal of cotton being cultivated and produced, but at present the price obtainable in the local markets exceeds 1*d*. per pound, the highest price offered by the British Cotton Growing Association, and therefore it is not available for export. The time will come, however, when the production will exceed local requirements, and cotton will be seen on the local market for less than 1*d*. per pound. The reason is as follows: the native is getting more and more accustomed to the use of silver currency; there is a growing demand for silver coin. He will, therefore, cultivate those crops for which he can the more easily obtain currency. There is no other crop for which he can obtain currency to the same extent as for cotton. Let buying centres be established, therefore, throughout the territory, ready to purchase cotton for cash at 1*d*. per pound. Once the native realizes that there is an unlimited number of shillings to be obtained in exchange for cotton, rather than any other produce the cotton will appear.

The extensive distribution of wages amongst the natives employed on railway construction has established the habit of spending money amongst a large section of natives in its neighbourhood. Railway construction having now ceased, those natives, in order to obtain money, have taken to collecting Shea nuts, for sale on a large scale, and the export of this produce has increased greatly. The moral to be drawn from this is that well-considered expenditure on public works of a useful description repays itself in three directions. There is, first, the benefit conferred upon the community by the increased facilities of transport and manufacture, a benefit for which the trade of the country can afford to pay. Next, the distribution of currency amongst the people. Lastly, the technical education of the native mind, the awakening of native ambition, and the consequent stimulation of their efforts towards the attainment of a higher state of economic prosperity than that they have hitherto enjoyed. I will close this paper with a few statistics which may be of interest. The figures are approximate only.

Dependency.	Northern Nigeria.	Southern Nigeria.	British India.	Egyptian Sudan.	Uganda.
Population	10,000,000	9,000,000	224,000,000	2,500,000	3,500,000
Area (square miles) ...	255,000	100,000	1,100,000	1,000,000	120,000
Population per square mile	40	90	224	2·5	30
Cost of administration per 1000 of pop.	£74	£200	£315	£612	£68
Cost of administration per square mile	£3	£20	£70	£1 10*s*.	£2
Land revenue per square mile	£1 10*s*.	Negligible	£21	?	?
Land revenue per 1000 of population	£40	,,	£92	?	?
Area (sq. miles) per administrative officer	2000	800	?	?	3000
Population per administrative officer	75,000	75,000	?	?	85,000

The PRESIDENT (before the paper): The author of the paper to which we are about to listen—I wish I could add the reader, but, for reasons which I will presently explain, I am sorry I cannot do that—is Mr. Temple, the son of our old friend, that great administrator, Sir Richard Temple. It is a particular pleasure to me to preside on this occasion, when a paper is being read the author of which is a member of that distinguished family, because I recall that on the first occasion when I ever read a paper in this place, Sir Richard Temple came down from the House of Commons to pay me the compliment of moving a vote of thanks, and therefore it is very agreeable to me to stand in an analogous position towards one of his sons. Unfortunately Mr. Temple is not here to read his paper himself. Returning from the sunny lands of Nigeria to this clime, of which on occasions the less said the better, he has contracted one of those chills with which all of us are familiar. But I have succeeded in persuading the lady, who only a few days ago united her fortune to his, to read the paper on behalf of her husband. She is all the more fitted to do so because her own experiences as Miss Olive Macleod have been largely and recently connected with that country, and I believe there has only to-day come out a book written by her, which I hope you will all of you purchase, describing her recent journeys in the heart of Africa. Her husband, Mr. Temple, unlike his distinguished father, whose service was devoted to the East, found his own interest attracted at an early age to Africa. He started in Brazil, but as soon as he could he got away from that country, and has devoted himself since for many years to the problems of that part of the British Empire which his paper describes. There he has assisted in the great work of developing our Protectorate in Nigeria, and in consolidating those Dominions which have now been united under the single hand of Sir Frederick Lugard, who is with us to-night. That eminent officer is going back again to Africa, to the scene of his former labours, to carry out this task. One of his ablest lieutenants will be the reader of this paper, and I have said enough about him to ask your sympathy and interest, not merely for the paper, but even more for the lady who has consented to read it on behalf of her husband.

The PRESIDENT (after the paper): Sir Frederick Lugard, whose name is so intimately connected with Nigeria, has just returned to this country from Hongkong, in order to take up for the first time the Governorship of a United Nigeria, and I hope he will do us the honour of saying a few words.

Sir FREDERICK LUGARD: There are many here this evening, including Sir H. Bell, who can give you more recent information about Nigeria than I can myself, but I am grateful for the opportunity of saying just a brief word both as regards the writer and the subject of the paper to which we have just listened. Mr. Temple is one of the small band of pioneers who went out to set up an Administration in Northern Nigeria some twelve years ago, under conditions which were arduous, for there was a great deal of sickness, and the health of almost all broke down. He himself was constantly sick, but he stuck to his work, and came back again and again to the country, although I had myself at one time a very serious misgiving that he ought to retire in order to save his life. But he pulled through, and he has lived to-day to see in a large measure the fruition of his hopes in a stable Government in that country. The paper which his bride has read for him this evening has the outstanding merit that it deals simply and plainly with facts, which are strikingly put. In contrast to a great deal which has been written and said about Africa, it is devoid of "window dressing." He does not commit himself to opinions on the merits and demerits of this man and that, or criticisms of past policy

and forecasts of policy in the future. He does not speak of Africa as a land which is enshrouded in mystery; but he deals with it as work in Africa should be dealt with, that is to say, as different neither in merit nor degree from honest hard work in any other part of the world. It is, however, quite true that in the early days the conditions of the country did involve a good deal of personal discomfort and a great deal of sickness, and I am the last man who would depreciate or discount the hardships which were endured, not only without complaint but with enthusiasm, by the band of men who worked with me in those days.

I think, sir, the time has come when the development of our African possessions should be treated as a plain, practical proposition, free from mystery and from empirical theories. Well-meaning bodies of philanthropists have sometimes considered it their duty to lay down rules for the guidance of the man on the spot. That was possibly commendable in the early days, when we knew very little about Africa, but we have been working hard, and the Colonial Office at home has worked hard, and we do know something more now about questions of land tenure, native prejudices, native law and customs, and that thorny question, slavery. We know a great deal more than we did when I first entered Africa twenty-four years ago, and I hope and trust that the British public will believe that the servants of the Crown are doing their very best, as every Britisher in this room would do, to act up to the traditions of his country. But I have digressed from the subject of the paper. You would, perhaps, be interested if I could tell you how the task of unification is to be carried out; but I confess that, until I return to the country, I am wholly unable to do so. I can claim some acquaintance with the problems of Northern Nigeria, with which I have kept touch since I left, but time has passed and has brought changes, and I have still to study the problems in Southern Nigeria. Mr. Temple told us that the revenue from Customs in Southern Nigeria had increased from one to two millions in five years; that the land revenue of Northern Nigeria had increased from £16,000 to £460,000 in eight years. These figures show that the country has enormous possibilities, if only the merchants and the people of the country itself will realize the outstanding fact that it is all one country, and each part of it is interested in the development of the remainder.

The chief need of the country, at any rate of Northern Nigeria, is an increase of population. In former years it was exceedingly dense, but it has been decimated by many years of organized slave raiding and inter-tribal war, and also by preventible diseases such as small-pox. So far as I could judge, however, the people were doing their best to remedy this defect even before I left. Credit is due to the Government of Southern Nigeria for having considerably decreased the strength of the foreign-made trade spirits imported for sale to the natives. The British tax-payer has preferred to give a grant-in-aid rather than to introduce spirits into Northern Nigeria, and that country, I am glad to say, is entirely free from the use of trade spirits. It is true we are precluded by the Brussels Act from importation to a country where the trade did not exist at the time the Act was ratified, but we were not so precluded when we first started the Government, and it is to the credit of the British nation that they have preferred to give those large sums rather than create a large and abundant revenue, by introducing spirits. Those who have been engaged in work beyond their strength and endurance in that country, can look with pride to the fact that their efforts have been directed to creating a revenue independent of liquor.

Though this progress in Nigeria has been so remarkable in point of revenue and material prosperity there is room for a still larger development if the

country is fully opened up by railways. I was looking lately at the Report of the French Budget Committee for last year, which shows a wonderful development, attributed to the institution of railways in the various French possessions in West Africa. They raised a loan of £6,600,000 sterling; to which they have added another five millions chiefly for railway construction, with the result that the volume of trade has practically doubled [from five to over nine million sterling] in ten years, and the exports are rapidly overtaking the imports. The profits on the railways for 1909 were 2,700,000 francs, and the revenue in 1909 was just three times what it was in 1900, yet so far as I know there is no French colony which is richer in resources than Nigeria. I think with this object lesson before us we may say with confidence that money laid out in railway extension in that country, is from a commercial point of view a sound investment. We have heard from Mr. Temple of other advantages of railway construction, the educative effect it has upon the natives, that it promotes the circulation of currency and enables them to pay their small taxes in a form which can easily be collected; it also greatly assists the Administration and enables us to decrease the military force.

I think we have begun to realize that Africa is no longer (as used to be said a few years ago) a land of mere jungles and swamps. Here is an extract, from the *Quarterly Review* of 1828, which describes the ideas prevalent about Africa at that date. The writer says—

"We trust that there will now be an end to the sacrifice of valuable lives in prosecuting discoveries in this wretched continent, of which we know enough to be satisfied that it contains little at all worthy of being known—a continent that has been the grave of Europeans, the seat of slavery, and the theatre of such crimes and miseries as human nature shudders to think of. The products for commercial purposes are few, and mostly confined to the sea-coasts, two-thirds of the interior being a naked and inhospitable desert, over which are scattered bands of ruthless robbers. Park's discovery of a great river running in a contrary direction to what had been supposed in modern times, and which was therefore concluded to be the Niger of the ancients, gave a celebrity to this re-discovered stream to which it now appears to have little claim, either for its size, its direction, or the length of its course; its size about Noofè being not more than two-thirds the width of the Thames at Westminster Bridge—its direction easterly, discontinued at or near Timbuctoo—and, if it actually does reach the sea somewhere in the Bight of Benin, which is still very doubtful, the whole length of its course does not exceed 2000 miles."

Well, we have progressed a little further than that in these days! and it is due to the hard work which has been done in Africa and also, sir, to the encouragement which has always been given by the Royal Geographical Society that we do know more of Africa to-day and have been able to develop our African possessions with some success.

Sir Hesketh Bell: The close attention which has been given to the paper we have heard to-night was due not merely to the excellence of its matter or, if I may say so, to the very charming manner in which the paper was read, but also to the very growing interest which is being taken by people in the Motherland in the progress of our great African Protectorates. The figures and statistics given in the paper have afforded the audience some idea of the vast area of Northern Nigeria, and of the great variety and complexity of the many problems which face us there. It has been mentioned that the revenue of Northern Nigeria has increased in the short space of seven years from £16,000 a year to nearly half a million. This is striking evidence of the growing wealth

and prosperity of the country, and when I tell you that nearly the whole of this large amount is raised by direct taxes on land, collected without difficulty and without the exercise of any force, we can realize the solidity of the foundations upon which our administration stands in Northern Nigeria. These great results have been mainly due to the enthusiasm and devotion to duty that characterize the conduct of every member of the Civil Service of Northern Nigeria. I should also add that the system of taxation which was described in the paper was organized by Sir Frederick Lugard and will stand as an abiding proof of the wisdom of the policy which he organized in the country. With characteristic modesty Mr. Temple in his paper has given but a slight idea of the very important part which he and his colleagues in the Administrative branch of the Northern Nigerian service have played in the development of our authority in that Protectorate. In less than ten years they have rescued the country from a condition of constant turmoil and from many of the horrors of the slave trade, and we are in a position to state to-day that in nearly every part of Northern Nigeria, life and property are almost as safe as in most of our English colonies. The senior residents in Northern Nigeria are men who have all had great experience of the country and who, especially, have a great sympathy for the people. They have spared no efforts to impress upon the native rulers and the people that we are really their sincere friends, that our measures for the improvement of their condition and for the betterment of their country are purely disinterested, and that we have no ulterior designs on either their property or their liberties. The people are, I believe, beginning to realize these facts, and the willingness with which they carry out the instructions and directions of the Political Officers is a proof of their confidence in our sympathy. Mr. Temple and his colleagues have formed a sort of "School of Administration" in Northern Nigeria upon which the younger and junior officers are now modelling their attitude and conduct towards the natives. So long as the policy of that School is maintained there need be no fear as to the continuation of the excellent relations which now exist between the protectors and the protected. It has been stated that His Majesty's Government has decided to place the two great Nigerian Protectorates under a single administration. Although some doubts are being expressed in certain quarters as to the advisability or practicability of such a move, in view of the diversity of conditions now prevailing in the two Protectorates, there can be but a single opinion on one point, and that is, that if any one can carry that scheme to success it is the distinguished officer who has been entrusted with the task.

Prof. WYNDHAM DUNSTAN: I was really not prepared to say anything this evening. I came here, in fact, expecting to hear a paper and a discussion on United Nigeria, in anticipation of the great work Sir Frederick Lugard has been called upon to carry out. I may venture to express satisfaction that so much public attention is now being given to this great country of West Africa. It is a notable fact that at two successive meetings of the Royal Geographical Society important papers have been read on Nigeria, whilst two important works—one by Mr. Morel and the other by Captain Orr—have recently appeared on Northern Nigeria. Northern Nigeria, and I may add the Empire, is to be congratulated upon having enjoyed a continuity in administrative policy. When Sir Frederick Lugard became the first High Commissioner, he laid down a general policy which has been loyally carried out and extended by his two successors, Sir Percy Girouard and Sir Hesketh Bell. That has been a very great advantage to the territory in every way. While the progress of the two Nigerias within the last few years has been very rapid, any one who has

followed that development realizes that there is an immense further advance to be made in the future. The vegetable resources have been only partly developed. Already there is a growing trade with Great Britain in palm oil, palm kernels and other oil seeds; but under European initiative, and with the aid of European capital, which has at last been attracted to the country, we may expect further great extensions of native industries. Mr. Temple, in the paper which has been so well read for him, has alluded to the very important discovery that was made by the Mineral Survey, of fuel in Southern Nigeria, following on that of tin in Northern Nigeria. As I have been closely connected with this work, I may make one or two remarks about it. Enormous deposits of coal have been found in Southern Nigeria, at Udi, and also of lignite at Asaba, in both instances not far from the River Niger. It is, however, necessary to add that the coal of Udi is not quite the same substance as the coal we have in this country. It is a coal of much more recent date, known to the geologist as tertiary coal, while the deposits of lignite are of more recent date still. At the same time they both make very serviceable fuel, and we must look for information as to how best to utilize them to Germany, where the lignite and brown coal industry has been developed to a very large extent, and where it is now one of the most important industries in that country. The real problem for Nigeria is how these deposits can be cheaply exploited for the benefit of the entire territory of West Africa, and especially for that system of railways which has come into existence within the last few years, and which is now entirely dependent upon the use of imported fuel. I think every one now agrees that Nigeria is a most valuable asset to the Empire, and more especially to many of the great manufacturing industries of this country, which can employ its raw materials. The administrative consolidation of Nigeria is a fitting continuation of the great work which Sir Frederick Lugard has already done in Africa.

The PRESIDENT: In closing this meeting you will agree with me when I say that we started it by listening to a very practical and business-like paper, well composed, and with precisely the sort of information we desire. Following upon that we have had an interesting and reasonably brief discussion conducted by experts of the highest order. With regard to Sir Frederick Lugard, I am sure there is no one of us here who does not wish him God-speed in the task he is about to undertake. He is returning in the autumn to a country where he made a great name, and where it is quite clear from the remarks that have been made that he takes with him the enthusiastic confidence of his subordinates. No man living is better able to carry through the task of consolidadation with which he has been entrusted. And, finally, must we not include in our vote of thanks this evening the reader of the paper, who sits at my side? I once heard a man in the anxieties of a wedding breakfast—no doubt one of the most serious moments of life—describe his wife as "the late Miss So-and-so." I might refer to the reader of the paper as the late Miss Olive MacLeod. Anyhow, I am sure you will wish me to include her in the compliment I am offering on your behalf. I trust you will authorize her to convey to her husband the thanks of the meeting, and me to convey your thanks to his wife.

THE RELATIONS OF KAMES AND ESKERS.

By Prof. J. W. GREGORY, F.R.S.

KAMES and eskers are the best known of the formations deposited by water from melted glacier-ice; but both names are used in glacial geology with different meanings. Thus Page * in 1865, Maxwell Close † in 1867, Lyell ‡ in 1873, A. C. Ramsay § in 1872, Penck ‖ in 1894, and many other authors, have used the terms "kame" and "esker" as synonymous. The British Geological Survey follows the same course. Thus the Drift edition of the Whitehaven sheet (101 S.W.) records in the Index "Eskers or Kames (mounds of sand and gravel)," and Sheet 107 S.E. (New Series, No. 17), on which the last date is 1888, refers to "eskers or kames" and not to eskers and kames. Many American authorities ¶ also use the term as synonymous, and the long ridges of glacial gravel in New England are accordingly described as kames.

Philology appears to confirm the view that the Irish term esker, the Swedish ás (plural åsar), and the Scottish kame are equivalent terms in the three languages. According to Maxwell Close,** esker means originally "nothing more than a ridge-shaped hill of any kind." Wright's Dialect Dictionary †† says that an esker is a ridge; and the word "kame" seems to mean the same. I have read the statement, although I forget where, that kame is actually derived from the same root as esker. But this origin seems improbable. So also is the suggested derivation of kame from the French "cime," a summit. It is more likely connected with the Teutonic "kam," a ridge, or the summit of a mound. Jamieson ‡‡ quotes a derivation from "ceum," a path.

Among standard dictionaries the Encyclopædic Dictionary (vol. 4, 1889) says definitely that kame is "the same as escar," and also (vol. 5, p. 305) that an os is called in Scotland a kaim and in Ireland an esker. The Oxford Dictionary gives a definition based on that of Page, and defines kame as a "steep sharp hill ridge; hence in geology one of the elongated mounds of post-glacial gravel, found at the lower end of the

* D. Page, 'Handbook of Geological Terms,' 2nd edit., 1865, p. 265.

† M. H. Close, "Notes on the General Glaciation of Ireland," *Journ. Roy. Geol. Soc. Ireland*, vol. **1**, 1867, p. 211. He says, "as is well known, the kames of that country [Scotland] are eskers."

‡ Lyell, 'Antiquity of Man,' 1873, p. 293.

§ A. C. Ramsay, 'Physical Geology and Geography of Great Britain,' 3rd edit., 1872, p. 160—"those marine gravelly mounds, called kaims or eskers."

‖ A. Penck, 'Morphologie der Erdoberflache,' vol. **2**, 1894, p. 54.

¶ See, *e.g.*, G. F. Wright, 'Ice Age in North America,' 5th edit., 1911, p. 343.

** M. H. Close, "Notes on the General Glaciation of Ireland," *Journ. Roy. Geol. Soc. Ireland*, vol. **1**, 1867, p. 212.

†† Vol. **2**, 1900, p. 260. "Ir. Eiscir, a ridge."

‡‡ T. F. Jamieson, "On the Last Stage of the Glacial Period in North Britain," *Quart. Journ. Geol. Soc.*, vol. **30**, 1874, p. 328.

great valleys in Scotland and elsewhere throughout the world; an esker or osar." *

Of the dialect dictionaries two may be quoted as examples. Wright† quotes a Northumbrian use of kame as synonymous with esker. "It is this which gives a billowy appearance to the valley . . . resembling the kaims or eskers of the coast" (Wilson, 'Eglingham,' 1886, p. 45). Jamieson ‡ may be quoted as the standard authority for the Scottish use of kame. "Kaim, Kame (1) A low ridge. Lanarks. (2) This term in Ayrs. is used to denote the crest of a hill or those pinnacles which resemble a cock's comb, whence the name is supposed to have been given. The term has a similar application in Shetland, 'Kaim is a name given to a ridge of high hills' (Edmonston's 'Zetl. Isl.,' 139). (3) A camp or fortress. (4) Kaim as occurring in the designation of a place, has been explained 'crooked hill.'"

Accordingly there is etymological evidence in support of those who, like Sir Archibald Geikie § and G. F. Wright,‖ accept kame as the Scottish, esker as the Irish, and ås or os as the Swedish names for the same formations. Nevertheless, in spite of etymology and historic use, the terms kame and esker are now often used for different types of glacial deposits.

The simplest basis of separation between these two formations is the restriction of kame to the mounds and hummocks, and of esker to the ridges. This principle has been generally adopted in Sweden, the classical land of the ås or esker, and it has been widely accepted. Thus in this country, Prof. James Geikie, who, in 1888, wrote of "kames or eskers," ¶ in 1905 ** restricted the term esker to ridges and described kames as consisting chiefly of mounds.

The separation of eskers as ridges and kames as mounds has been widely adopted. Thus it has been accepted in America by Profs. Chamberlin, Salisbury, and Davis.†† The two first authors speak of "ridges of gravel and sand known as eskers (osars and serpentine kames

* The insertion of post-glacial in the above definition is unfortunate. Asar and Osar are the plural forms, but are often used as the singular.

† J. Wright, 'English Dialect Dictionary,' 1, 1898, p. 704.

‡ J. Jamieson, 'An Etymological Dictionary of the Scottish Language,' vol. 3, new edition, 1880.

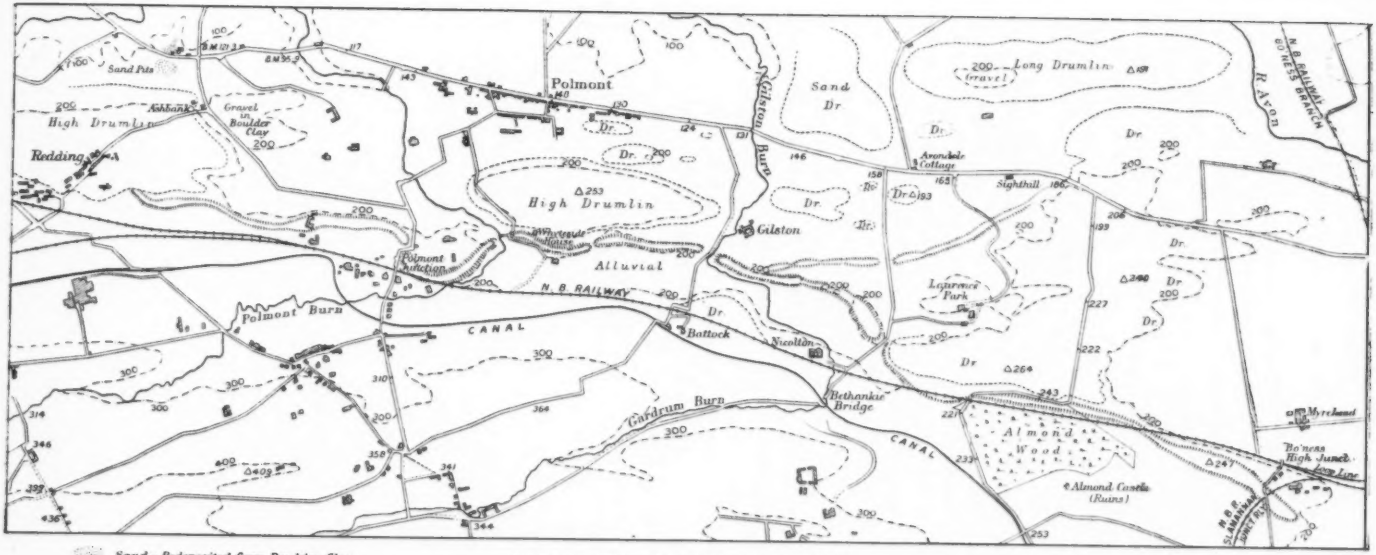
§ A. Geikie, 'Text-book of Geology,' 1882, p. 892. Also 'Scenery of Scotland,' 3rd edit., 1901, p. 344.

‖ G. F. Wright, 'The Ice Age in North America,' 5th edit., 1911, p. 339.

¶ James Geikie, 'Outlines of Geology,' 2nd edit., 1888, p. 369.

** James Geikie, 'Structural and Field Geology,' 1905, p. 311—"tumultuous groups of closely associated mounds, hummocks, and ridges, known as kames." He speaks of "the long winding ridges (known as eskers)." He attributes them partly to sub-glacial rivers, also to *debris* spread out over the lowland by water due to the melting of snow and ice on the adjacent highlands. He distinguishes kames from eskers, also in his 'Great Ice Age,' 3rd edit., 1894, pp. 207, 209.

†† W. M. Davis, 'Physical Geography,' 1900, p. 337—"the ridges are called eskers."



MAP OF THE GLACIELUVIAL KAME NEAR POLMONT.

Scale 1:25,000 or 1 Stat. Mile = 2·53 Inches.

and kames of authors),"* showing moreover their recognition of the widespread synonymous use of the terms; but they limit kame to mounds or at least to short ridges; they remark, "the hills and short ridges are known as kames."† In Germany Prof. Supan ‡ defines kames as irregularly arranged "hugel," and eskers as long, linear åsar or "Eskerrucken." On the other hand, esker is definitely adopted for mounds as well as ridges by Mr. T. V. Holmes,§ who speaks of "esker mounds and ridges"; the Encyclopædic Dictionary does the same for åsar, as (vol. 5, p. 305) it describes an os as "a hillock or mound of drift-gravel and sand."

The distinction between esker and kame simply based on form is unsatisfactory and indefinite. A genetic basis of separation was suggested by Prof. T. C. Chamberlin in 1883,‖ and renewed in a modified form in a letter quoted by Stone in 1899. In the latter, he proposed to restrict kame to marginal and transverse fluvio-glacial formations, and eskers to those which have been deposited by glacial rivers more or less at right angles to the edge of the ice. Kame had previously been used in America for marginal fluvio-glacial formations as by Carvill Lewis.¶

Mr. Stone ** himself adopted a different interpretation of the term, and even distinguished between eskers and osar. He says,†† "I retain the term 'osar' for the longitudinal gravel system, and shall for the present employ the work 'esker' as a general term applicable to any mass or ridge of glacial gravel irrespective of genetic classification. Thus, if a series of separated deposits be known as a discontinuous osar, we need some term to apply to the separate mounds and ridges, and for such purposes I employ the word 'esker.'" He thus includes in eskers mounds as well as ridges; according to him a mound of fluvioglacial gravel is an esker. He speaks (*op. cit.*, p. 368) of "isolated kames" as "short eskers," and again (*ibid.*, p. 448) of "reticulated eskers or kames." He says that "the reticulated kames are not a distinct class of systems, but a peculiar form into which the longer gravel systems here and there expand. They were deposited by the same glacial rivers that left the osars and other types of gravels." ‡‡

* Chamberlin and Salisbury, 'Geology,' vol. 1, 1904, p. 292.

† *Ibid.*, p. 293.

‡ A. Supan, 'Grundzüge der Physischen Edkunde,' 5th edit., 1911, p. 604.

§ T. V. Holmes, "Geology of Carlisle." *Mem. Geol. Surv.*, 1899, p. 43. The same view is expressed in his paper "On Eskers or Kames," *Geol. Mag.*, Dec. 2, vol. 10, 1883, pp. 438–445, in which he describes as eskers some deposits on the rainless coast of Peru which are clearly not glacial in origin.

‖ T. C. Chamberlin, "The Terminal Moraine of the Second Glacial Epoch." *Third Ann. Rep. U.S. Geol. Surv.*, p. 300.

¶ Carvill Lewis, "Marginal Kames," *Geol. Mag.*, Dec. 3, vol. 1, 1884, pp. 565–566.

** G. H. Stone, "The Glacial Gravels of Maine and their Associated Deposits," *Monographs of the U.S. Geol. Surv.*, vol. 34 (Washington, 1899), p. 359.

†† G. H. Stone, *ibid.*, pp. 359–360.

‡‡ G. H. Stone, *ibid.*, p. 449.

The distinction between kames and eskers seems a desirable course, and the basis of separation recommended by Chamberlin, in his letter to Stone, seems to me the most convenient, as its use of the terms is the most appropriate geographically. For kame is a Scottish term, and it should be applied to the Scottish type of these deposits. The term has, no doubt, been applied in Scotland to various kinds of gravel hills, and even to moraines;* but the typical Scottish kames were formed as marginal deposits. Thus, the most representative Scottish kames are those at Carstairs, and they were deposited as a marginal formation in front of a receding glacier. They were not deposits in the beds of glacial rivers, like the typical eskers of Sweden, Ireland, and New England.

The eskers of Ireland and Scandinavia no doubt include both types. Dr. Sederholm,† for example, speaks of marginal osar, which, according to the nomenclature adopted in this paper, are kames; and when Maxwell Close,‡ in 1867, established the Irish use of the word esker by separating drumlins from eskers, he included in the latter both marginal and transverse ridges, and also mounds.

The typical eskers were certainly deposited by glacial rivers. The long controversy whether eskers were formed by subglacial rivers—Hummel's theory§ (1874)—or in supraglacial rivers—Holst's theory‖ (1877)—has ceased before the explanation advanced by Hershey¶ from the eskers of Illinois and applied by De Geer to those of Sweden, that they were laid down where a glacial river emerged from the ice-sheet and deposited its material as a fluvioglacial fan. As the ice front receded the deposits of successive years formed a continuous gravel ridge, which followed the retreating mouth of the river. Such ridges are, therefore, banded in structure, and, as Hershey and De Geer have shown, the major stratification in the eskers is a seasonal result.**

The coarse wash deposited by the spring floods is followed by layers of finer material as the volume of the river diminishes in the summer; and thus there is a passage from cannon-shot gravel, through fine gravel, to sand. I know of no case of such seasonal banding in the Scottish kames.

---

* Knox's definition of kame—"a small hill of gravel or sand made by a glacier" in Stanford's Glossary would include many moraines.

† J. J. Sederholm, "Sur la Géologie Quaternaire et la Géomorphologie de la Fenoscandia," *Bull.* No. 30, *Com. Géol. Finlande*, 1911, p. 3.

‡ M. H. Close, "Notes on the General Glaciation of Ireland," *Journ. R. Geol. Soc. Ireland*, vol. 1, p. 209 (1867). He states that the eskers of Roscrea include "ridges and mounds."

§ D. Hummel, "Om Rullstensbildningar," *Bih. K. Sven. Vet. Akad. Handl.*, vol. 2, No. 11, p. 1874.

‖ N. O. Holst, "Om de glaciala Rullstensasarne," *Geol. För. Förh. Stockholm*, vol. 3, 1876–1877, pp. 97–112.

¶ O. H. Hershey, "Eskers indicating stages of Glacial Recession in the Kansan Epoch in Northern Illinois," *Amer. Geol.*, vol. 19, 1897, p. 241.

** *Ibid.*, p. 242.

Hence, though the balance of authority is in favour of treating eskers and kames as synonymous, the balance of convenience appears to be in favour of their distinction. Eskers are essentially ridges of gravels and sands deposited along the courses of glacial rivers; they have been built up into long ridges by the overlapping of successive delta fans, and their course is usually at a high angle to the edge of the ice. The typical kames, on the other hand, are marginal deposits formed on the edge of a melting ice-sheet, and are not necessarily fluviatile.

The term "kame" cannot, however, be limited to marginal deposits without departing from its generally accepted meaning; for kame is applied to many mounds of gravel which are simply the remnants of former sheets of gravel.

Thus, J. R. Green* correctly states that "some so-called eskers† are certainly nothing but mounds which have been carved by denudation out of a thick sheet of gravel."

In addition to these residual kames and those composed of fluvio-glacial material, there is a third variety of kame, the formation of which may be described as glacieluvial. These glacieluvial kames are represented by an example at Polmont, which has long been known as one of the most esker-like ridges in the south of Scotland. It runs for 4 miles beside the North British Railway line from Glasgow to Edinburgh. Its course is shown in the map (p. 171). Its composition, structure, and variations in level are all inconsistent with the view that it was the deposit of a glacial river. The majority of the pebbles retain the angular form of the stones in boulder clay, though the striæ have been removed by the scour by muddy or sandy water. The kame contains some thin slabs of soft sandstone which cannot have been rolled far in a stream. The kame, moreover, is unstratified, or only obscurely stratified, and it contains no bands of sand. Its level rises and falls across the country, so that if it be due to a subglacial river, it would be due to a violent torrent in a confined tube-like channel; and the evidence is opposed to its deposition under such conditions.

The kame appears to have been formed as a bank of wash quietly deposited along the margin of a melting glacier at one stage of its retreat. It is a colluvial and not an alluvial deposit.‡

The Scottish kames may therefore be divided into three classes, which, with eskers, may be defined as follows:—

I. *Esker.*—A fluvioglacial ridge formed of sand and gravel which has been laid down along the course of a glacial river. The deposition has taken place mainly where the river emerged from the glacier, and the course of the esker is usually at a high angle to the edge of the glacier.

* J. R. Green, 'Physical Geology,' p. 469. 1876.

† He uses esker as synonymous with kame. *Op. cit.*, p. 468.

‡ The structure of this Polmont kame has been recently described in a paper before the Geological Society of Glasgow.

II. *Kame.*—A mound or ridge of gravel or sand, deposited by water on the margin of a melting glacier, or formed by denudation from a sheet of fluvioglacial gravel or sand.

(1) Fluvioglacial kames are composed of false-bedded sands and gravels, and are formed as marginal deposits; for example, the kames of Carstairs.

(2) Glacieluvial kames are formed of gravel and sand deposited as a bank of wash along the edge of a melting glacier; for example, the Polmont kame, near Falkirk.

(3) Residual kames are mounds of sand and gravel left by the denudation of sheets of fluvioglacial material which had been deposited in glacier lakes, or on the flanks of hills of boulder clay from which their materials have been derived; for example, the kames at Gateside, near Kilsyth, and around Mount Vernon, to the east of Glasgow.

The term "kame" has been applied to terminal moraines. Thus a well-defined moraine near Balfron is described on the Geological Survey Map of Scotland (Sheet 38) as a kame. Jamieson * explains both kames and eskers as moraines of gravelly *débris* deposited on the edge of an oscillating ice-sheet; the ridge-like form he considers due partially to the ice on its advance pushing the material before it. There may be a transition from kames to moraines through gravelly moraines, but it seems advisable to separate kames and eskers, which are by water deposited, from moraines, of which the material is simply dropped *in situ* from melting glaciers.

THE USE OF FORMULÆ IN QUANTITATIVE GEOGRAPHY.

By B. C. WALLIS.

In the January number of the *Journal*, attention was called to the constancy, within certain limits, of many of the facts of quantitative economic geography. This regularity in the quantities produced and exported of certain commodities is of importance because of the wide range of cases in which it occurs, and because it provides the possibilities of measurement in geographical investigations. There is, however, a further importance. It is found that certain articles do not present the same uniformity of development in all the countries of the world, as the proportions at one period of time differ greatly from the proportions at another period. Examples of this kind of commodity are the coal production of the world and the supplies of wheat to the United Kingdom; while, in general, minerals are more liable to discordant exploitation than other articles. These facts give added importance to an attempt to investigate the causes why certain commodities yield constants and why others fail to be so regular.

For the purposes of an inquiry which is dominated by the question,

* T. F. Jamieson, *op. cit.*, pp. 329-330.

"Why so much?" it is a great convenience to be able to summarize the quantitative facts in a concise form, and the main purpose of this note is to suggest the adoption of a nomenclature and system which will make such concise summaries possible.

Abbreviations for the names of countries could be standardized, *e.g.* Uk. might be used to designate the United Kingdom, Us. for the United States. A list of suggested abbreviations is appended.

Provided such abbreviations are adopted, it will be possible to summarize the main features of the constant values regarding various economic facts by means of formulæ.

Simple formulæ.

World production of maize,	$Us._{\frac{3}{4}}R._{\frac{1}{4}}$
,, ,, coffee,	$Br._{\frac{4}{5}}R._{\frac{1}{5}}$
British supplies of sugar,	$Ge._{\frac{1}{2}}R._{\frac{1}{2}}$
,, ,, cotton,	$Us._{\frac{3}{4}}R._{\frac{1}{4}}$

In these formulæ the letter R implies the rest of the contributing countries: hence the United States produces $\frac{3}{4}$ of the world's maize, and sends $\frac{3}{4}$ of our supplies of cotton; Brazil produces $\frac{4}{5}$ of the world's coffee, and Germany sends $\frac{1}{2}$ of our sugar supplies.

More elaborate formulæ.

World production of rye,	$Rs._{\frac{2}{5}}Ge._{\frac{1}{5}}R._{\frac{1}{5}}$
,, ,, cotton,	$Us._{\frac{3}{5}}In._{\frac{1}{5}}R._{\frac{1}{5}}$
,, ,, tobacco,	$Us._{\frac{3}{5}}In._{\frac{2}{5}}R._{\frac{1}{5}}$
,, ,, rice,	$In._{\frac{5}{12}}Ch._{\frac{4}{12}}R._{\frac{3}{12}}$
,, ,, tea,	$In._{\frac{4}{5}}Ch._{\frac{1}{5}}R._{\frac{1}{5}}$
,, ,, coal	$^{**}Us._{\frac{7}{10}}Uk._{\frac{2}{10}}Ge._{\frac{1}{10}}R._{\frac{1}{10}}$
British supplies of rice,	$Bu._{\frac{3}{4}}In._{\frac{1}{4}}R._{\frac{1}{4}}$
,, ,, tea,	$In._{\frac{3}{5}}Cy._{\frac{2}{5}}R._{\frac{1}{5}}$

These formulæ indicate, for example, that Germany produces $\frac{1}{4}$ of the world's rye, the United States $\frac{3}{5}$ of the cotton, India $\frac{1}{5}$ of the tobacco, and $\frac{5}{12}$ of the rice, and that Burma sends us $\frac{3}{5}$ of our rice, Ceylon $\frac{1}{5}$ of our tea.

Some mark may be added to the formula, as in the case of coal in the above table, to denote that the proportions indicated are unstable and liable to more or less violent fluctuations.

Formulæ may be combined and expanded in various ways, the following are only suggestions.

The relation between home supplies and imports may be indicated by the use of the letter H for home supplies: *e.g.* British supplies of wheat may be expressed simply by the formula $^{**}H_{\frac{1}{5}}R_{\frac{4}{5}}$, which means that the home production is $\frac{1}{5}$ of the total. The proportions in which other countries send us supplies may be indicated as follows: $^{**}Us._{\frac{1}{3}}Be._{\frac{1}{3}}R._{\frac{1}{3}}$ which means that $\frac{1}{3}$ of our imports come from the various parts of the British Empire, and

another $\frac{1}{3}$ come from the United States. These two formulæ may be combined in the following way: $^{**}H_1(Us._1Be._1R._1)_4$ which implies that the British Empire and the United States each supply $\frac{1}{3}$ of $\frac{4}{5}$, *i.e.* roughly $\frac{1}{4}$, of the wheat used in the United Kingdom. In the case of wool the home supply is $\frac{1}{5}$ of the imports, formula $H._1R._5$. The imports are noted by the formula $Au._2Nz._1R._2$, and the two simpler formulæ are combined in the form $H._1(Au._2Nz._1R._2)$, from which may be inferred the fact that Australia supplies $\frac{2}{5}$ of $\frac{5}{6}$, *i.e.* $\frac{1}{3}$ of the total quantity, and that New Zealand supplies half of this, *i.e.* $\frac{1}{6}$.

In somewhat similar way the relation of the British Empire to the rest of the world may be expressed in simple formulæ, and the details may be added to the formulæ to develop a more complicated summary. For example, the world's sheep may be expressed in the form $Be._1R._3$, which means that the Empire contains $\frac{1}{3}$ of the world's sheep. The details for the sheep within the Empire may be summarized: $(Au.Nz.)_2Uk._1R._2$, which means that Australasia contains $\frac{1}{2}$ of the Empire's sheep. If it were desired to express the relationship between Australia and New Zealand, the form might be: $(Au._4Nz._1)_2Uk._1R._2$, which would imply that Australia contains $\frac{4}{5}$ of $\frac{1}{2}$, *i.e.* $\frac{2}{5}$ of the sheep in the Empire.

This formula could be combined with the formula for the rest of the world as follows: $[(Au._4Nz._1)_2Uk._1R._2]_1R._3$, from which it could be inferred that New Zealand contains $\frac{1}{10}$ of $\frac{1}{3}$, *i.e.* between 3 and 4 per cent. of the world's sheep.

If it were desirable to add to this result the details for the sheep in the rest of the world, the form $Us._1Ag._1Rs._1R._3$ might be used, and this could be combined with that of the Empire as follows: $Be._1(Us._1Ag._1Rs._1R._3)_2$, which would summarize facts such as "Argentina contains $\frac{1}{6}$ of $\frac{2}{3}$, *i.e.* $\frac{1}{9}$, of the world's sheep."

The reader will, possibly, have reached the conclusion that formulæ such as the latter examples are cumbrous and therefore to be eschewed: obviously, the only justification for their use lies in their convenience. Which is to be preferred? A lengthy table showing percentage values, a set of statements showing fractional values, or a formula which yields definite relationships upon inspection? The answer to this question is more or less a matter for the individual, but there can be little doubt of the extreme convenience of the more simple formulæ as a concise summary of the relative importance of the different countries in the world in regard to commodities such as those which have been considered. On the ground of convenience for the memory it may be suggested that such formulæ are useful, and it may be added that such summaries would serve in many cases instead of diagrammatic representations of economic facts with the double advantage of being easy to reproduce in print and quantitative in value.

It is necessary to conclude with a caution. The results expressed formally in this way cannot pretend to a high degree of accuracy, but then isotherms and similar map conventions cannot in most cases imply any greater degree of accuracy, yet geographers find them extremely useful.

Suggested abbreviations (specimens only).

Single letters never represent countries.

R = the rest. H = Home supplies.

Ag. = Argentine	In. = India
Ah. = Austria-Hungary	It. = Italy
Au. = Australia	Mx. = Mexico
Be. = British Empire	Nz. = New Zealand
Br. = Brazil	Ne. = Netherlands
Bu. = Burma	Pu. = Peru
Ch. = China	Uk. = United Kingdom
Cn. = Canada	Ur. = Uruguay
Cy. = Ceylon	Us. = United States
Fr. = France	Vz. = Venezuela
Ge. = Germany	

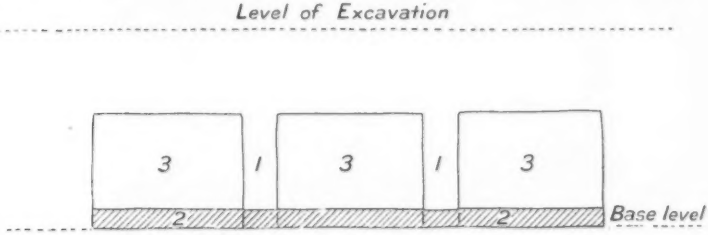
ON THE WATER SUPPLY OF HILL FORTS IN WESTERN INDIA.

By F. J. VARLEY.

THE hill forts of Western India are mostly situated in commanding positions upon the summits of the western Ghats, and other hill ranges, which intersect the hinterland. The forts in the interior are often placed upon isolated hills, which rise up in a conspicuous manner from the general level of the tableland of the Deccan, and the plain of Khandesh. Historically it may be shown that they are strategically well placed to defend lines of communications and trade routes, or to serve as strongholds dominating wide tracts of level plain.

In character they vary considerably, from the elaborate hill forts such as Partabgarh, Raigarh, Asirgarh, and others to the small forts placed on isolated hills, of which Laling and Songir in Khandesh may be taken as examples. The summit of these hills is usually a plateau varying in extent from a few acres up to several hundred acres; the edge of the plateau terminates in a nearly sheer wall of rock or scarp, from 100 to 300 feet high, and this scarp only requires very slight fortification to render it impregnable against any assault. In the case of the larger forts there are two or more lines of artificial fortifications lower down the hill, which serve as lines of defence to the main fort on the summit. Through these lower fortifications, by means of gateways and zigzags, is led the path which gives access to the summit, the final approaches to which are sometimes of the most complicated and stupendous construction: for instance, the approach to the summit of the far-famed Fort of Davlatabad is led by a series of spirals carved out of the solid rock, and placed entirely within the rock-surface of the scarp.

It is not the purpose of this paper to enter into the very interesting questions connected with the history of these forts, or the traditions relating to their early occupation. Many of the forts are in an excellent state of preservation still, but the majority are fast disappearing under the stress of successive monsoons and neglect to effect any repairs. Now, it is obvious that the expedient of digging wells within the area of these hill forts cannot be resorted to, the geology of the region in which they are situated showing a uniform layer of trap rock which covers such a vast area of India to a great depth. Springs can only exist on the plain, where percolation through the fissures of this most impermeable stratum is alone possible. This fact was well known to the builders and occupiers of these hill forts, who knew that an adequate supply of water situated upon the hill itself, within the area of the fortifications, was a prime



1. Rock pillars
2. „ ledge
3. Openings to interior of Cistern

PLAN A.

necessity in case of a siege, when the expedient of bringing up water from the base of the hill would be impossible.

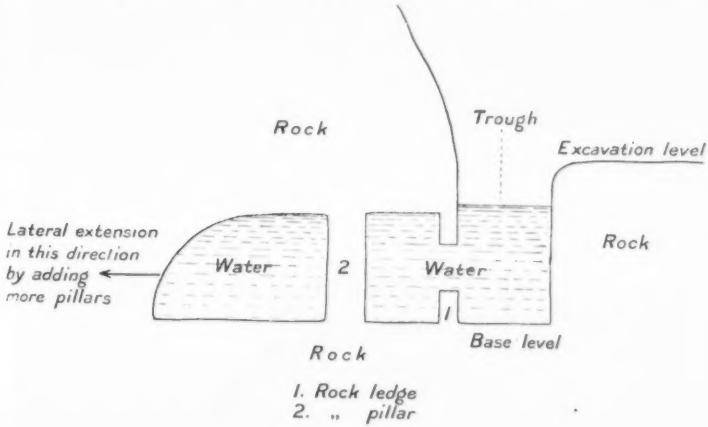
Where the area of the summit is considerable, as at Asirgarh, they improved any natural depressions, or hewed out of the solid rock artificial depressions, and collected in them the rain which fell on the summit by means of very carefully devised drains. These ponds of rain-water are known as *talaos* (or tanks). At the small and unimportant fort of Songir, the area of whose summit is very small, a most remarkable square hole has been cut in the solid rock, the labour involved being incredible. I measured the dimensions of this *talao*, and found it to be 66 feet × 63 feet, with a depth of no less than 70 feet, which is about the height of the scarp of this fort. It might appear at first sight that this was labour thrown away, but as the hill does not from its construction admit of any outer defences, the plateau would have to be held, if at all, on the water collected upon it, and it is a primary objection to these shallow *talaos* that the water dries up. Consequently the defenders of this small fort would have to rely upon a device, which, in character, is midway between the open *talaos* and the rock cistern to be presently noticed.

TROUGH OF ROCK CISTERN ON LALING FORT.

NORTH-EAST ANGLE OF GULNA FORT.

Even in a year of abnormally low rainfall this tank held water; there was a tradition in the village that it was bottomless, which at least went to show that it was regarded with some veneration.

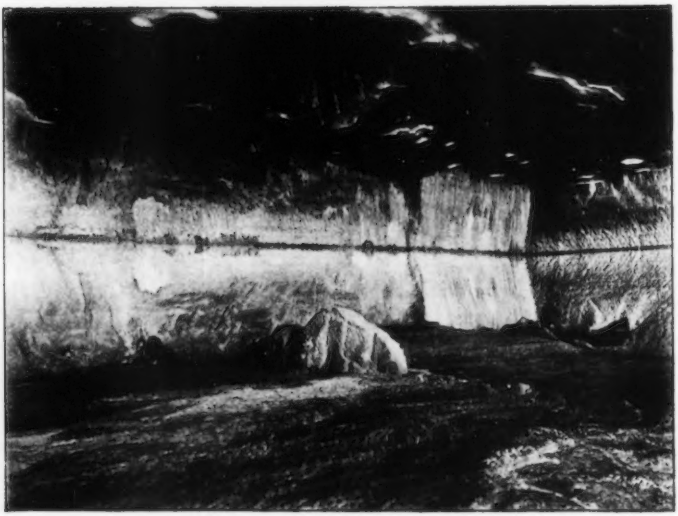
For those forts, however, which have no considerable plateau at the summit, or have defensive works lower down the hill, cisterns of remarkable construction were evolved. These cisterns are hewed out of the solid trap rock, and though they differ considerably both in size and construction, the principle underlying them all is the same. The problem was to conserve, as far as possible, all the rain which fell on the hill, and when the area of the hill was very limited, to collect and store the rain in open tanks, would have been to invite failure, for not only would there have been the chance of the water putrefying, but there existed the far greater danger of the limited supply disappearing altogether.



PLAN B.

The evaporation for seven or eight months of the year is excessive, the relative humidity rarely rising above 40°, and frequently sinking to zero, consequently their small stock of water would rapidly disappear. From their practical experience of the effects of evaporation they evolved a rock-cistern, which could hardly be improved upon for the purpose for which it was intended. These rock cisterns, or *takis*, are cut out of the hillside in the solid rock. From the marks left on the sides of them, it would appear that they were cut with small chisels. There are several characteristic *takis* on Laling fort. The exterior view of one shows the trough and the entrance. The only evaporation which goes on is in this trough, the large body of water in the interior being completely free from contact with the outer air. Of the plans one (A) shows the front of the cistern with the excavation level removed, the other (B) shows the side view, the lateral extension with the hillside being usually considerably

GALNA HILL.



INTERIOR OF ROCK CISTERN, GALNA FORT.

greater than shown. Similarly the floor level of the inner chambers is usually below the base level of the trough in front of the chambers.

About halfway up Laling fort there is a succession of these cisterns round the hill, and Bhils produced one of their number whose uncle had fallen into one of the troughs, when drunk, disappeared, and mysteriously reappeared in one of the cisterns on the far side of the hill. These cisterns often communicate with an adjoining one, and the uncle when questioned admitted, rather shamefacedly, that he had only dived into the next trough, through an opening which he discovered on siphoning out the water. We undertook this experiment to test if there was any sign of spring action, as these cisterns were situated halfway up the hill. After emptying out many thousands of gallons we reduced the water to such a level that we were able to get into the trough and examine the inner chamber; we left marks and examined the level from time to time, but beyond very slow evaporation (the water having been siphoned out much below the base level of the trough) there was no alteration in the level to speak of. Certainly there was not a vestige of spring action. On examining the hillside we found an old drain leading to the cistern, and by the end of the next monsoon it was as full again as before. This experiment was admittedly not conclusive, but from the conditions prevailing on these trap-rock hills, I should be inclined to hold that there is a total absence of spring action in these cisterns.

Some of them, where fissures have appeared in the rock, do not hold water, but they differ considerably in construction from rock chambers which have been excavated in the hillside for storing food or war material.

A very large cistern with a pool in front, instead of a trough, is seen at Davlatabad fort.

A good illustration of the inner chamber of one of the cisterns with the pillars corroded is taken from Galna fort. Above the second line of defence there is a long row of these cisterns and chambers cut in the hillside. In these cisterns, which after the lapse of so many years since their construction hold water well, the water appears to be remarkably clean and pure, and I am told that water in large quantities is able to purify itself.

We found fish and crabs in several of the cisterns; the age of the water in some of the disused cisterns must be considerable. It has been suggested to me that the cisterns to be found on these hill forts are the work of Buddhists, and that they were appropriated by their successors, but the question is really an historical one, and all that one can safely say is that they were constructed when blasting was unknown, and must either have taken years to excavate, or have been excavated by abundant forced labour in view of military contingencies; local tradition does not help one in the matter, and these cisterns are not peculiar to hill forts, but are found on lines of communication in the hills, where water is scarce.

THE DISTRIBUTION OF EARLY BRONZE AGE SETTLEMENTS IN BRITAIN.*

By O. G. S. CRAWFORD.

In this paper I propose to isolate a single culture period and to examine it from a geographical point of view. The period selected is the earliest phase of the British Bronze Age, when metal implements were known, but still comparatively rare and confined to a few simple types. By studying the distribution of certain objects which characterize the period, I hope to throw some light on the people who introduced them, and to connect them with contemporary migrations on the continent.

Amongst the objects which Sir Richard Colt Hoare discovered in the barrows round Stonehenge at the beginning of the last century, there was a class of pottery vessels which were seen even then to belong to a clearly distinct type. They were smaller and of a finer texture than ordinary ones, and were generally found with skeletons. Sir Richard called them "drinking-cups," and Mr. Abercromby has recently suggested the alternative name of "beakers." From the evidence of associated finds, it is clear that these beakers are contemporary with one of the earliest forms of metal implement known, the flat celt or axe of copper or bronze.

On the two accompanying maps I have shown by a dot every site where beakers or flat celts have been found.† The maps may therefore be taken to indicate with fair precision the areas occupied by the people of whom this pottery and these implements are characteristic. It will be seen at once that the dots cluster thickly together in certain regions, leaving others bare. It will also be seen that the clusters on the beaker-map usually coincide with those on the flat celt map. We will consider each of these groups in order.

The first region stands along the east coast of North Britain from Cromarty Firth to the mouth of the Tees. There is but a single break where the Kincardine hills come down to the sea immediately south of Aberdeen. It is bounded very roughly by the 500-foot contour line. The second region comprises the Yorkshire wolds, south of the Vale of Pickering and East of the Vale of York. The third is the Peak District of Derbyshire. The fourth is the south-eastern "shore-line" of the Fens between Stoke Ferry and Newmarket. The fifth consists of a series of nearly continuous groups between the Thames at Oxford and the chalk hills of Southern Dorset. There are a few small groups indicated on one or other of the maps, one round Penrith on the borders of Cumberland and Westmoreland, another at the mouth of the Mersey, and a third at Weymouth.

These groups (which must be regarded as indicating, not the total extent of the population, but only that portion of it which used flat celts and beakers) are capable of being explained by geographical factors. If we take the Peak District and draw a line round it to mark the limit of the outcrop of Carboniferous limestone, we shall see that it exactly encloses all the beakers, and all but one

---

* Royal Geographical Society, Research Department, February 14, 1912.

† For the data contained on the beaker map I am indebted to the Hon. John Abercromby, F.S.A. Scot., who has most kindly allowed me to see the proof-sheets of his work on Bronze Age Pottery. A few additional sites are marked. The flat celt map is from data which I have compiled myself from published notices of finds and from my museum notes.

or two of the flat celts which have been found in it. If we draw a similar line to show the bare chalk of the wolds, we shall find that it likewise shows the limits of beakers and flat celts. The Fen margin is less obvious at first sight, but that is only because the control is more geographical. The finds are all sandwiched between the "drift" country in the south-east and the alluvium of the Fens on the north-west. They occupy just that region where the "shore-line" of the Fens is formed of chalk. Near Newmarket the boundary-line of the alluvium turns from south-west to north-west, running across the outcrop of strata at right angles, while the chalk scarp continues its course

FIG. 1.—FLAT CELT FOUND NEAR NEWBURY.*

south-westwards. Similarly, north of Stoke Ferry, secondary rocks crop out and separate the chalk from the alluvium. We thus get a tract of between 20 and 30 miles where an invader sailing up the Ouse and its tributaries could land straight on to the chalk instead of on to Greensand scrub or Gault forest. Following the chalklands south-westwards, we find a large gap on both maps until we reach the Thames. This gap coincides with the region where the chalk is for the greater part covered in drift, and was hemmed in by Gault forest on the north-west, and on the south-east by barren Tertiary heaths passing through scrub into the low-lying forest of London Clay. Beyond the Thames the

* Reproduced by kind permission of Mr. Harold Peake, Hon. Curator of the Newbury Museum.

chalk stretches without a break to the Dorset coast. It is, moreover, accessible by boat at both ends. It would be easy for invaders to sail up the Thames on the look-out for suitable camping-grounds, and there would be little to invite them until they reached the Goring gap. They could then spread out over the

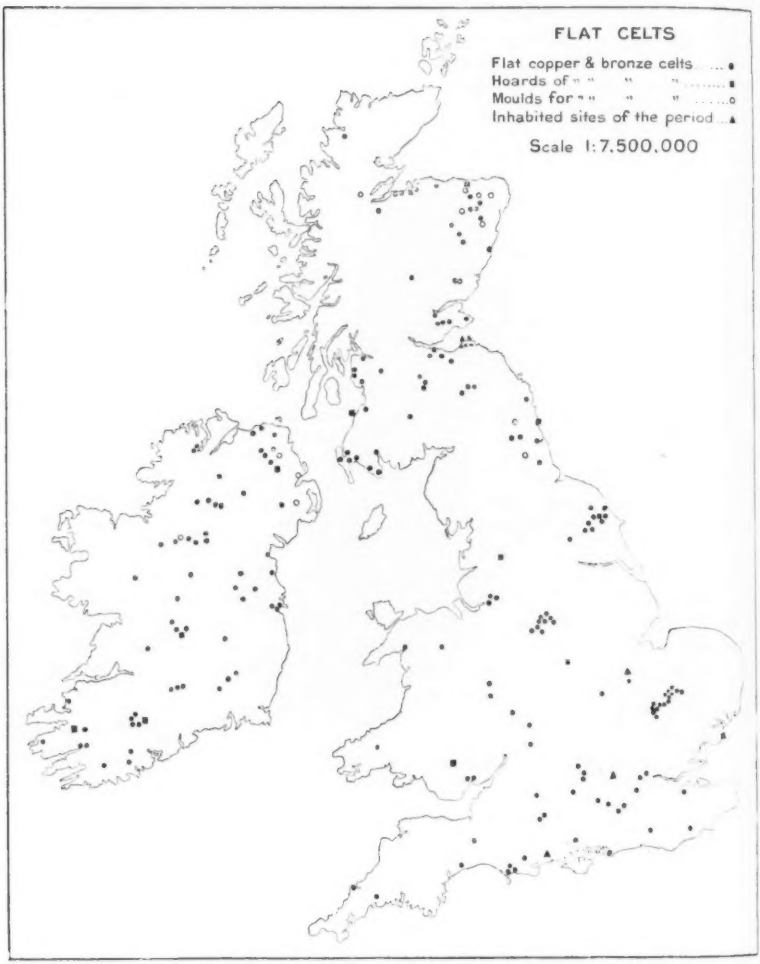


FIG. 2.

Berkshire and Marlborough downs, leaving the forested Chilterns unmolested. Or, if they landed on the south coast, they could either reach the chalk at once from Weymouth, or, by an easy passage over open country, up the Avon valley from Christchurch, or up the Itchen from Southampton. There is here no

great forest barrier, because, owing to the greater angle of dip, the outcrop of London Clay is much narrower. Here, too, the rivers form better routes for marching along, since they are generally flanked by a level stretch of hard gravel.

It remains to consider the North British coastal region. To take the northern portion first, we see that there is a large area in the north and east parts of Aberdeenshire. This is a lowlying region of great fertility. At the present day it contrasts strangely with one's preconceived notions of Scotland. It is a region of Archæan rocks whose coastal margin is covered round the Moray

FIG. 3.—BEAKER FOUND JULY 2, 1909, ABOUT 4 FEET BELOW THE SURFACE AT FURZY, A GRAVEL SPUR ON THE RIGHT BANK OF THE AVON, FORMING PART OF LATCHFARM, CHRISTCHURCH, HANTS. SCALE ABOUT $\frac{1}{4}$.*

firth with a layer of Devonian sandstone. The whole region as far south as Durham is one of relative warmth and dryness. When, moreover, we take into account its inviting position with relation to the opposite shores of the continent, we shall understand how desirable a region it must have seemed to an invading people.

Before leaving the subject of beaker regions, we may pause a moment to consider the blanks on the map, which are no less instructive. The first big

* This photograph was kindly given me for reproduction by Mr. Herbert Druitt, of Christchurch, who owns the beaker.

blank which strikes one is that of Ireland. With two possible exceptions, no beakers have been found in Ireland.* When we turn to the flat celt map and see what a large number of dots there are in Ireland, and when we bear in mind that a far greater number are not inserted because the sites of discovery are not known, we are confronted with a difficult question. If it was the beaker people who brought with them the knowledge of bronze, how did it reach Ireland, where beakers are not found, and where we have no reason to suppose the beaker people ever settled? I suggest that the knowledge of bronze reached Ireland through trade, mainly the gold trade, and that the abundance of copper ores there soon made it a great centre of bronze production. The tin required may have been obtained from Cornwall, perhaps from the Iberian peninsula. I do not propose to discuss the question here; but I might add that some of the evidence in favour of Cornwall will appear incidentally in the paragraphs dealing with the gold trade.

Another big blank covers the Midland district of England. This is for the most part a region of clays and sands, and would be either dense forest or uninviting scrub, and it seems to have been the last part of England to be permanently settled. Hunting bands in a Stone Age culture may have roamed in it and survived there until very late times, but even of this there is, so far as I know, little evidence. Wales and the Scotch highlands are likewise regions of refuge rather than of settlement. The rarity of flat celts in Cornwall and Devon I cannot explain; it is contrary to what one would expect, and especially when compared with the amazing richness of Brittany in remains of the early Bronze Age.

Now that we know where in Britain the beaker people settled, we will see what can be found out about their physical characteristics. Certain skulls found in round barrows and associated with beakers have been carefully examined and measured. Most of them have a high cephalic index, generally about 81 or 82, and in almost every case over 80. "The eyebrows must have given a beetling and probably even formidable appearance to the upper part of the face, whilst the boldly outstanding and heavy cheek-bones must have produced an impression of raw and rough strength."† Their stature was about 5 feet 9 inches.

They are represented at the present day in certain parts of England by such types as Beddoe's Bronze Age Cumbrian.‡ I have noticed a man of this type living in Oxford. Both these regions were settled in small numbers by the beaker people, and they lie sufficiently off the main "invasion districts" to allow the type to survive. This tall, round-headed race is the one which is usually called

---

* One exception is from Mount Stewart, co. Down (see *Dublin Penny Journal*, 1832). Situated on Strangford Lough, the beaker (if a true beaker) could quite easily have come across from the opposite shore of Scotland. That this was the regular crossing-place at the time is shown by the map of lunulæ. Coffey, however (*Journ. Anthr. Inst.*, **32**, 396), does not consider that this example belongs to the beaker class; the only record of it which survives is a figure in the journal quoted, and others also figured there which *do* survive are seen to be inaccurately drawn. The other exception is "fragments of at least three distinct vessels of the beaker class" from Moytirra, Sligo (Wood Martin, 'Rude Stone Monuments of Ireland,' figs. 146–148; Coffey, *loc. cit.*). These, says Coffey, are "the only examples which can at present be referred with certainty to Ireland." They are in the Dublin Museum.

† Greenwell, 'British Barrows,' pp. 644–5.

‡ 'Races of Britain,' Plate III.; Ripley, 'Races of Europe,' No. 109. Compare Ripley, Nos. 103 and 111.

the Bronze Age race. But this is incorrect, as the latest phase of the British Bronze Age was undoubtedly introduced by a fresh set of invaders, as I hope to be able to show some time. It has also been called Goidelic, but this again

FIG. 4.

is impossible, since practically no beakers are found in Ireland, and, according to Rice-Holmes, not a single skull of the characteristic Round Barrow type has ever been found in Ireland, and only four brachycephalic skulls which can be referred to prehistoric times.*

* 'Ancient Britain' (1907), p. 432, where numerous references are given.

Leaving the question of physical affinities to be dealt with by others, we will see what light is thrown by archæology on the origin of the round-headed invaders. In this I am only following out the discovery made by Mr. Abercromby, who was the first to run the beaker people to earth.* On the accompanying map I have marked in black the chief continental beaker areas.† There are seen to be seven large groups: one in the Veluwe and in Drente round the Zuyder Zee; one in Hesse at the confluence of the Rhine and Main, with a small region to the south between the Rhine and the Neckar; a large region in the basin of the Saale, with an offshoot in Havelland; and one round Stettin and the mouth of the Oder; and two regions, the one centring round the confluence of the Bohemian tributaries of the Elbe, and the other round the Moravian tributaries of the March. The continental distribution so indicated is not quite exhaustive, but it brings out clearly some at least of the regions from which the invaders came. This grouping is confirmed by the distribution of flat celts which has been mapped by Lissauer,‡ and with which should be compared the distribution of certain contemporary types of bronze pins. From these regions, down the Rhine and the Elbe, came the round-headed invaders. Probably they left their homes before the knowledge of metal had arrived; but that this knowledge followed close on their tracks is highly probable. Certain types of metal§ objects, especially crutch-shaped pins and pins with ring-heads, can be traced from Britain across into Germany and up the Rhine and Elbe to Bohemia. We can likewise trace to Bohemia the curious little conical buttons with V-shaped perforations which are found all over Great Britain, and indeed wherever else beakers are found.

To account for the invasion of the round-heads, I will develop the following hypothesis, which I think agrees with the existing evidence. At any rate, it is an attempt to connect events in Britain with those which were taking place at the same time in Central Europe and the Mediterranean. It is, I think, in accord with the ideas current on the Continent, but has not, so far as I am aware, been worked out in detail from a purely British point of view.

To whatever part of Europe and the Northern Mediterranean we may turn, we find, entering in with the first knowledge of metal, a certain disturbing element. Northern Italy felt the shock of two sets of invaders. The first horde came from Switzerland and founded the western group of Italian pile-dwellings, with their centre probably about the Lake of Varese. The second came from the east, and that branch of it which reached Italy founded the eastern group of pile-dwellings round the Lago di Garda; eventually the pile-dwellers crossed the Po and built the Terremare.‖ Perhaps the same impulse drove another horde south-eastwards to build the second city of Troy, whose material has analogies with Europe rather than with the Mediterranean. An infiltration of broad-heads is noticed in Crete from the beginning of the Bronze Age, but the wave had probably spent itself, and the immigrants came in peace and perhaps to trade. In Egypt the knowledge of metal coincides with the

---

* *Journal of the Anthropological Institute*, vol. **32**, 1902, pp 373-397.

† See Fig. 6. For notes of some additional beakers I am indebted to Mr. E. Thurlow Leeds, M.A., F.S.A.

‡ *Zeitschrift für Ethnologie*, 1904.

§ "Metal" is used in this paper to denote objects which may be of copper or of bronze. The probability that all such primitive forms as awls, flat daggers, and beads are of pure copper, increases with every fresh analysis.

‖ Peet, 'Stone and Bronze Ages in Italy,' ch. xviii. Clarendon Press: 1909.

FIG. 5.—MAP OF THE FEN DISTRICT TO SHOW THAT FLAT CELTS AND BEAKERS ARE MOST FREQUENT WHERE THE "SHORE-LINE" IS OF BARE CHALK.*

* The large white square represents a find of three flat celts at Fordham; they are not known have been found together.

appearance of an intrusive round-headed element—the "Giza people" of Elliot Smith.*

If we compare the material of these different cultures, we shall find a remarkable similarity between them. Some of the Terramara pottery is remarkably like that from the second city of Troy, so far as one can judge from illustrations. A special form of round-bottom saucer-like vessel occurs in Spain, the Terremare, Germany, and Yorkshire. Everywhere the arrowhead of flint and the slate or bone wrist-guard are found, denoting a hunting people. And if we search for a region where these and other characteristic features of the culture are found, we shall find it in Bohemia. Here is probably the home of the beaker. The little copper awls, so common with female skeletons in England † and, curiously, under similar conditions in Italy,‡ are common in Bohemia.

Such, stated in barest outline and with scores of telling resemblances omitted or left unproved for lack of space, is my view of the first invasion of Britain of which we know anything definite. I regard it as the last ripple of a great wave starting in the East and affecting every culture in Europe and Western Asia. The impetus probably came ultimately from the desiccation of Asia. We cannot as yet distinguish the beaker culture beyond Bohemia and Moravia, but we may before long be able to see signs of it further east. In any case, Bohemia was probably a secondary centre of diffusion. Its geographical position makes it such. It is quite likely that this unrest in Central and North-West Europe was due to pressure of emigration from the grasslands stretching eastwards from Hungary. This may have caused each of the groups from Bohemia westwards to "shift up" one or more places.§

However, whatever may have happened, there can be no doubt that the beaker culture has close analogies with that of the Rhine and the Elbe. These relations were continued after the arrival of the round-heads through the medium of trade intercourse. I do not propose to consider such problems as whence the people of Aberdeenshire obtained copper and tin for making their flat celts. That it was by trade and from afar is proved by the absence of suitable ore in Scotland; ‖ the nearest tin was to be found in Cornwall and Wicklow,¶ but the tin of the Erz Gebirge is quite as accessible. I have chosen

* 'Ancient Egyptians,' p. 151 (Harper's "Library of Living Thought," 1911). The author says that he detects a marked resemblance between the traits of the "Giza" skulls and those of the Round Barrow people of Britain, and the hypothesis by which he accounts for this resemblance is substantially the same as the one here developed.

† Amongst instances which I have collected, out of ten where the sex could be determined with certainty, nine were females.

‡ Compare Peet, p. 242.

§ Peet, p. 261.

‖ Cassiterite has recently been discovered in the granite gneiss of Carn Chuinneag in Ross-shire, but it is highly improbable that the deposit, even if it was ever present in sufficient quantity, would have been known or worked in prehistoric times in so inaccessible and then uninhabited a region ('Summary of Progress, Geol. Survey,' 1903, p. 58).

¶ Tin-stone was also found in Wicklow during the gold streaming of the end of the eighteenth century. Its occurrence was noted by Weaver (*Trans. Geol. Soc., Lond.*, 1 S., vol. **5**, 1821, p. 135), but little attention was then given to it. In 1850 William Mallet wrote as follows: "From the comparatively small portion of sand [not more than 150 lbs.] which I had an opportunity of examining, I obtained about 3¼ lbs. of stream tin, a portion of which, being reduced, yielded an ingot

another metal—gold—as showing more clearly the course of trade. Amongst the objects which can be assigned to the Early Bronze Age in Britain* are certain crescent-shaped objects of gold of paper thickness. The accompanying

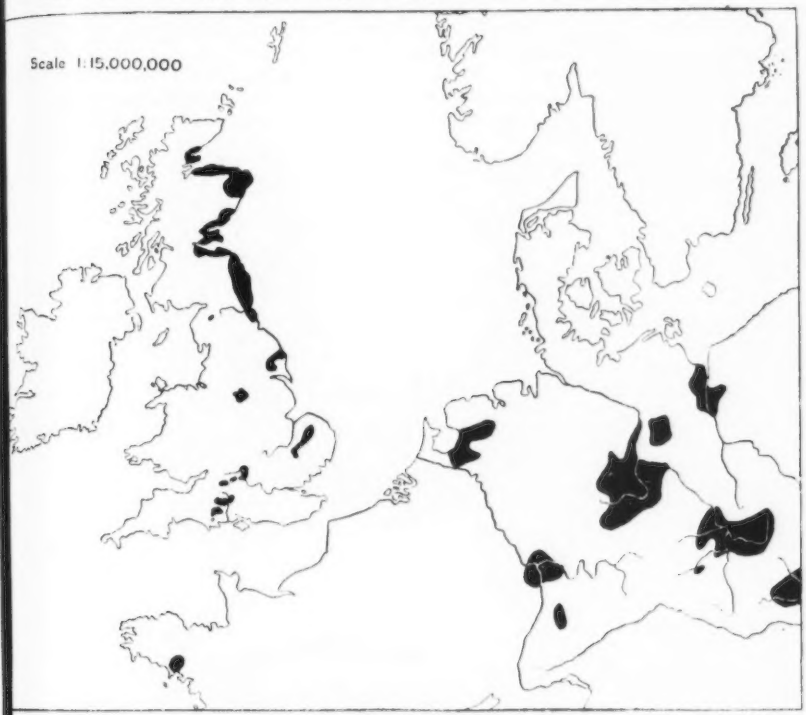


FIG. 6.—THE PRINCIPAL SETTLEMENT AREAS OF THE BEAKER PEOPLE IN BRITAIN AND ON THE CONTINENT.†

map sufficiently explains their range of distribution. It will be seen that by far the greater number have been found in Ireland. A few, however, have

which, when refined by a second fusion, is hardly inferior to the finest grain tin. Should this mineral be found in the mass of the sand in a quantity at all approaching that in which it existed in the specimen from which this tin was obtained, it would probably richly repay the labour and expense of its collection and smelting. . . . The mineral itself occurs in grains varying in size from fine sand up to pebbles of half an inch in diameter" (*Jour. Geol. Soc., Dublin*, vol. **4**, 1851, p. 272). If it can be shown that other valleys in the Wicklow mountains were once, or still are, equally rich in tin, it will become highly probable that the discovery of alloying copper was made here, since we now know that gold was mined in Ireland at least as early as the first phase of the Bronze Age.

* Two of them were found associated with a flat celt at Harlyn, in Cornwall. See *Archæological Journal*, vol. **22**, 1865, p. 277, and most text-books.

† The Continental regions are founded upon map B in Pič's 'Starozitnosti,' vol. **1**, part i. 1889, and the British regions upon lists in Mr. Abercromby's work on Bronze Age pottery.

been found in Britain and on the Continent, and these resemble the Irish specimens both in shape and ornament. It is rather a specialized type, and independent invention is inconceivable. We are therefore driven to the conclusion that the gold lunulæ have been spread, probably through trade, but certainly by persons in close touch with the culture of Ireland.

That Ireland was once rich in alluvial gold is beyond question.* It is now worked out, but in 1795 gold was found in a secluded valley of the Wicklow hills, and a miniature gold-rush occurred. A large amount was obtained by the peasants before the Government took over the workings. Several thousand

FIG. 7.—GOLD LUNULA, FOUND NEAR SCHULENBURG, ON THE RIVER LEINE, HANOVER.†

* The subject of the Irish gold trade was first broached by Montelius in 1891 (*Archiv für Anthropologie*, xix. 1–21). It was discussed by Coffey (*Proc. R. Soc. of Antiquaries, Ireland*, 1895), by Sir Arthur Evans in the Rhind Lectures in 1895, and in his Presidential Address at the British Association Meeting in 1896. M. Salomon Reinach introduced it to France in a review of Sir Arthur Evans's address in the same year (*L'Anthr.*, vol. **7**, 688–9), and subsequently developed it in two articles dealing chiefly with gold lunulæ (*Revue Celtique*, vol. **21**, 1900). At the meeting of the French Archæological Congress at Beauvais in 1905, Comte Costa de Beauregard read a paper on Lunulæ and Gold Torques, both of which he derived from these islands.

† This photograph was kindly sent me by the Director of the Hanover Museum, to whose courtesy I am indebted for permission to publish it.

pounds' worth of gold were obtained, and a nugget weighing 22 ozs. This stream was evidently overlooked by the prehistoric people, who washed the gold from the gravels of all the others.

That gold was obtained in Ireland during the Bronze Age is made certain by the extraordinary number of datable gold objects which have been found in Ireland. In the Museum of the Royal Irish Academy at Dublin, one wing of a long gallery is filled with cases containing the gold ornaments which have been found in Ireland; and the number which have been consigned to the crucible is probably still greater.* In fact, Ireland has well been called the

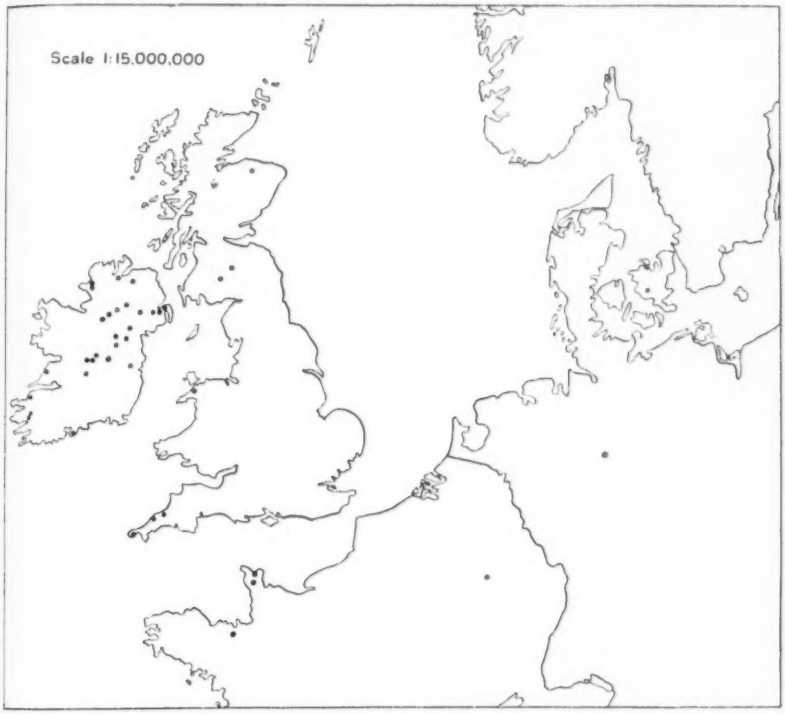


FIG. 8.—THE DISTRIBUTION OF GOLD LUNULÆ OF THE EARLY BRONZE AGE.†

El Dorado of the ancient world. Its extraordinary wealth—in copper ore, as well as in alluvial gold—situated for the most part near the sea, must have made it one of the most wealthy countries in North-Western Europe.

* In 1862 some jewellers estimated that they had received as much as £10,000 worth of such ornaments: see Wilde, 'Catalogue of Gold Antiquities,' p. 4.

† Every lunula whose site of discovery has been recorded is marked upon this map. The gold of Wiltshire is traced to Ireland by Rice Holmes in 1907 ('Ancient Britain,' p. 168), and the distribution of lunulæ is discussed by Coffey in 1909 (*Proc. R. Irish Acad.*, p. 251). Finally, the question of the route followed by the gold traders across England was treated by Mr. Peake in 1911 ('Memorials of Old Leicestershire,' pp. 31–45).

What was the course of the trade which the Irish goldfields created? The distribution of lunulæ shows us that there was intercourse in two directions —to Denmark and Northern Germany on the one hand, and southwards across Western France on the other. The shortest route from Wicklow to Denmark would be across England from Carnarvonshire or the mouth of the Mersey to the Wash. Now, if we look at the flat celt map we shall see that there is a cluster of three celts round Warrington on the Mersey, pointing to the existence of a port there. I would further suggest that, apart from geological considerations, the reason why the Peak District has provided so many more flat celts than any other English region of Carboniferous limestone is because it lay right on the course of this trade-route between Ireland and Denmark. The eastern terminus of the road may well have been at Peterborough, where an undoubted beaker settlement has been found,* and two beautifully worked flint daggers of a type frequently found with beakers.† The course of the southern gold route is indicated by the group of two separate finds of gold lunulæ round Cherbourg. The Cotentin peninsula projects into the Channel towards the opposite and roughly equidistant harbours of Weymouth, Christchurch, and Southampton. At all of these there is evidence of occupation on one or other of the maps—three celts‡ at Weymouth, a probable settlement and a beaker at Christchurch, and a flat celt at Southampton.§ Christchurch is the natural port of Wiltshire, and corresponds to Peterborough on the northern route; and just as a large settlement area grew up on the one in the Peak District, so the region round Stonehenge became the metropolis of the Chalk uplands. The abundance of gold found by Sir Richard Colt Hoare in the Wiltshire barrows is almost certainly due to its position on this gold-route.

It is even possible to trace the exact course followed. If we look once more at the flat celt map, we shall see a line of finds stretching from North Wales to Christchurch and the neighbouring harbours. All of these finds are *isolated* finds, unaccompanied by any traces of settlement and generally at fords. This is just where we should expect them to be lost by a travelling pedlar. An exception which confirms this is the rarity of beakers outside their respective groups. A traveller would not take a clumsy thing like a beaker with him, but he would be very likely, on such a long journey, to take—and use—his bronze axe.

A few suggestive finds of lunulæ are recorded in Cornwall. They are interesting because they raise the question of the existence of isthmus roads in Britain at this time‖ The fact that Cornwall is a peninsula makes it dangerous to rely too much on this evidence, but it is a peninsula that would not have been rounded by early navigators without sufficient cause. The finding of a

* *Archæologia*, vol. **62** (1910), pp. 333-352.

† As, for instance, in the Wick Barrow in Somerset (see the report on its excavation by H. St. G. Gray [Taunton, 1908], p. 31, where five other associated discoveries of beakers and flint knives are cited).

‡ The number is probably greater, as many of those in the Dorchester Museum have no locality, but are almost certainly local finds.

§ There is more unpublished evidence, especially for Christchurch, which cannot be given here.

‖ On the subject of isthmus-roads in the Mediterranean see Victor Bérard, 'Les Phéniciens et l'Odyssée,' vol. **1** (1902), bk. ii., ch. i. The author attributes the importance of Mycenæ, Troy, Sybaris, Decelea to their situation on isthmus-roads, which enabled them to take toll of the merchandise.

solitary flat celt in the Pembroke peninsula and another at the port of Swansea suggests that there was a third route from Wicklow to the south, partly by land and partly by sea.

Before concluding I would point out that the evidence of the later Bronze Age, so far as I have examined it, fully confirms the above outlines of the

FIG. 9.

gold trade, while it appears that the settlement-areas had shifted considerably It is only by the laborious process of collecting notes of finds—finds which often lie neglected in remote museums--and by mapping the distribution of these finds that we can hope to attain certain and exact knowledge of a period like the Bronze Age.

Captain LYONS: In the absence of Dr. Myres, who is unable to be present, I will ask Mr. Crawford to read his paper on the "Distribution of Early Bronze Age Settlements in Britain."

Captain LYONS (after the paper): I have no first-hand knowledge of the subject myself, so I am quite unable to appraise the weight to be assigned to the very interesting coincidences Mr. Crawford has brought before us this afternoon.

Sir ARTHUR EVANS: We are all very much indebted to Mr. Crawford for his very interesting paper, largely, as he says, suggested by Mr. Abercromby's researches. One fixed point to bear in mind is that Ireland, at the close of the Neolithic times, was a kind of El Dorado of the West, and we see the connections thus brought about between Ireland, Germany, and Denmark, and other Continental regions introducing various new elements into Britain. Not only have we bronze thus coming in from over the North sea and the Channel, but we find the spiral ornament, which had apparently reached Denmark and the lands of the lower Elbe through the old amber trade with Central Europe and the Danubian basin, propagating itself in Ireland, though we have much fewer traces of it in this country. New Grange supplies good examples of this and other decorative motives introduced in this way.

One of the great difficulties suggested by Mr. Crawford's researches is that although we have the evidences of trade relations, and see the spiral ornament coming in from the Elbe region, the "beakers" which he brings into connection with this line of intercourse are so far as is known very sparsely represented in Ireland. That is a remarkable fact. But on the other hand, as Mr. Crawford has shown by a very suggestive map, the distribution of these beakers extends over a large part of the West and South of this island. We must also remember that besides the valleys of the Rhine and the Elbe, and some Central European areas, such as Bohemia and Moravia, they are found in the south of Europe. Their distribution can be traced throughout Western Gaul to the Iberic peninsula. One or two have been found as far afield as Sicily. They are, I think, more at home in Spain and Portugal than Mr. Crawford quite seems to realize, and it must be also borne in mind that archæology there is in such an inchoate state that a single specimen of an object may well have the real equivalents of a much larger number. There is one point, moreover, in connection with their southern distribution which has struck me, and that is that at the end of the Stone Age and the beginning of the early Metal Age in Southern and Eastern Spain there are certain caves of that period which have been explored, and in one of those have been found, together with objects of the earliest Metal Age, certain bags of esparto grass which look as if they could not be other than the prototypes of these clay beakers.* Now, of course, it is quite possible that in early times the esparto fabrics of Spain may have had a considerable vogue, and even have spread to distant European areas. I cannot help thinking that evidence may eventually be forthcoming of a line of such commerce running along the west of Gaul. We see, at any rate, traces of an early trade route at the beginning of the Bronze Age along that route. Occasional finds of Iberic types of bronze implements have been even made in these islands, some in Cornwall, and one or two in Ireland; and on the other hand, a certain number of gold finds have occurred along this Iberic

* Since this statement has been made, I have been convinced by some observations of Mr. A. A. Fergusson Leeds, who has a first-hand knowledge of ancient Peruvian sepultures, that the accounts published by Gonzora, on which it was based, are, in part at least, due to a mystification. Some of the objects found in the Cueva de los Murciélagos are clearly Peruvian! How they were introduced into the cave is another question.

route, some of which are certainly, and others probably, derived from Irish sources. The evidence is by no means clear, and we can only hope that further researches on the truly scientific lines which Mr. Crawford has been following, may enable him to throw a much clearer light on these early trade lines.

Mr. Henry Balfour: I have nothing to add to this controversy, but I should like to ask a question of Mr. Crawford. First of all, I would like to congratulate him on having embarked on what I certainly regard as a most useful piece of research. The collation and mapping of the scattered material relating to specific types must lead to important results. I think that already it has led to giving us some results of a highly suggestive and interesting character. When he speaks of "flat celts," I would rather like to know definitely exactly what he includes in that term. Does he include all the types of copper and bronze celts which may reasonably be described as flat; those which have even rudimentary transverse stops and flanges, which might be described as flat, but which must be regarded presumably as very much later than those primitive copper and bronze celts which practically imitate the neolithic type of celt? I should like to know very definitely from him how much he includes in his term "flat celt" as applied to his maps, because a considerable period of time must have elapsed during the evolution of the higher types, and I hope that in publishing his paper Mr. Crawford may be induced to give a tabulated statement of the material, stating definitely what types he includes, what his material is, and giving a definite statement of the individual specimens on which his conclusions are based, and in what museums and collections they are located at the present time. I suggest this really in the hope that what he has done may lead to something further, because I should regard a tabulated statement as a kind of "ground-bait" which would attract further information. Maps, such as Mr. Crawford has produced already, although extremely valuable at the present time as they are, are still more valuable when they are allowed to grow, and the attraction of fresh material for his own use into his own fold, used on similar lines to his, will prove of immense value to the subject and will cause his piece of research, which is to some extent in the initial stages, to develop into something extremely fruitful.

Mr. R. A. Smith: Mr. Crawford has brought the Early Bronze age home to us this afternoon, and I am glad to find his researches have added to the material collected in the prehistoric chapters of the Victoria History. Pioneer work is the most difficult, and generally leads to further research. These chapters were written by people interested in particular counties, who have done their best to bring together material which would otherwise have run the risk of being lost. It is something to have swept together the available literature, and Mr. Crawford has filled up some of the gaps. The few criticisms I should like to offer refer to matters of principle. In the first place, from the archæological point of view, I do not think it is quite fair to associate the "flat celts" (whatever that term implies) with the "beakers." To my mind they belong to two different races. Mr. Abercromby's map shows the settlements of the beaker-using people, and his view is (or was in his early papers) that these people came over the North sea. The map certainly suggests that that was the case, but at the Glasgow Exhibition last year I was assured by a local archæologist that many beakers had been overlooked in the districts near Glasgow, a point rather against Mr. Abercromby's view that these people came from the east. Of course the beaker people, once arrived in Scotland, may have wandered west and down into the middle and south of England; and I believe some got to Ireland, because, besides the instance given by Mr. Crawford in his paper, there was a group of beakers discovered at Moytirra in co. Sligo. Then again, with regard to the beakers, I should like to know what types he includes.

Mr. Abercromby has isolated the calciform, or tulip type, which is the earlier one, the others being derived from that and more closely connected with those in Bohemia and Germany. A beaker, therefore, wants some sort of definition as well as the flat celt, and ought not to be associated with the flat celt; the map itself shows that they are of distinct origin. Ireland is full of flat celts, but only a few beakers have been found there. That in itself shows that they belong to different civilizations, and I do not think that the beaker people brought bronze over with them. Stone celts in Ireland are very numerous, so numerous that they become rather monotonous, and the flat celts are evidently derived from the stone celts. There is no break at all in the evolution, which shows that the Irish bronze industry was indigenous, and was not brought by the beaker-using people. In spite of one alleged discovery in association with a flat celt, the crescents may not go back much before 1000 B.C., whereas early flat celts go back to 2000 B.C., and from their number I should think that Ireland probably led the way in bronze-working, at least in this part of the world. That is not altogether a novel idea, because Canon Greenwell and Mr. Parker Brewis have contended that the bronze spear-head was evolved entirely in the British Isles. On the Continent spear-heads are either very primitive or of a highly developed form, the intermediate stages not being represented. If we could evolve the spear-head, we could also evolve the celt. We ought not to imagine that an abundance of flat celts means that the country was behind-hand. In certain districts that might be the case, but in Ireland occur all the stages in the evolution of this implement. The tulip-beaker on the Continent is generally associated with dolmens, or at least occurs mostly in the dolmen area. In Brittany it is very common, and I understand there are a great many found in Guernsey. It looks as if the original beaker came along the Mediterranean and up the west coast of Spain and France to various parts of England. Mr. Crawford's work, based as it is on scientific lines, is of a kind that must have a great effect on the future of English archæology; and if he can do for England what Lissauer did for Germany, he will certainly benefit archæology, and I hope himself.

Mr. HAROLD PEAKE: I must add my congratulations to Mr. Crawford for his treatment of the early Bronze age, for I feel that these maps, and others drawn on similar lines, will help to solve many problems connected with early trade. I cannot quite agree with Mr. Smith that the beaker people and flat celt people must be different, because the maps of these objects do not coincide, for beakers are household articles and show where people live, while celts may be articles of commerce and indicate the lines pursued by their owners in trade. Nevertheless, with Mr. Smith, I feel that Mr. Crawford has not yet proved that the beaker people first introduced metal to these islands. The general lines shown by the celts and the gold objects, which may, perhaps, be somewhat, but not much later in date, seem to show that there were two main streams of trade running to Ireland; one from Spain by the west of France, and the other from the mouth of the Baltic. In neither of these directions is it clear that beakers are found, while they are common in the region between these lines, where gold ornaments are absent. When a new people arrive simultaneously with a new culture, it is natural to conclude that one must have introduced the other; but this may prove a fallacy. It is possible that climatic causes may have driven two or more peoples to move at the same time. The general conclusion that I should arrive at from Mr. Crawford's maps is that the people of the Baltic, having learned the use of metal from trade with the Mediterranean, came to Ireland in search of gold, while simultaneously the beaker people arrived in England from the Rhine and the Elbe, and a trade arose with Spain. Had the beaker people carried on this trade in bronze and gold, we should expect to find some evidence of their occupation in the neighbourhood of the Irish goldfields,

and some Irish gold objects in their original homes in Central Europe. But further investigation on the lines begun by Mr. Crawford should solve the problem, and I should like to support Mr. Balfour's suggestion that Mr. Crawford should publish lists of beakers and celts, without which the maps will lose much of their value.

Mr. S. Hazzledine Warren said that when staying at Freshwater, in the Isle of Wight, some years ago, he saw a collection of ancient pottery in the possession of a Mr. Robert Walker, of that place. Most of these vessels were cinerary urns, but among them was one very beautiful beaker. Unfortunately the speaker did not know what had become of this. The original owner was now dead, but it might be recovered if inquiries were made. It was found at the foot of Afton Down. The speaker also referred to Eastern Essex, where he had done a good deal of work for some years past, as a beaker locality. Below the salt marshes of Eastern Essex there is a buried prehistoric surface, and this surface yields a large number of stone implements very similar to those found in the round barrows, together with fragments of the beaker. This surface passes down below low tide, and is overlaid by the tidal clay, so that these beaker-using people lived in this country before the last submergence took place. He thought that this was an important point in working out the geography of the time, and one which might also influence some of the trade routes. It is remarkable that on the rising ground, inland from these Essex marshes, he had not yet been able to find any of the characteristic industry of the beaker-using people. This looked as if they were invaders from the sea. Some thought their flint to be non-British; it is certainly non-local, and may not improbably have come by water.

Dr. J. W. Evans: I should like Mr. Crawford to tell us what his opinion is as to the source of these beakers. Were they in all cases manufactured in the different localities in which they are now found, or did those who used them bring them with them when they invaded the country, or acquire them by way of trade?

Mr. Crawford: I am afraid there is not time to reply to all the most interesting criticisms that have been made, but I must thank you all very sincerely for coming here this afternoon and making them, and for the very favourable way in which you have received my paper. I only hope it may induce others to help in *mapping* the distribution of type-objects.

Sir Arthur Evans has mentioned the discovery of prehistoric string-bags in Spain, and I venture to suggest additional evidence in support of the derivation of beakers from basket prototypes. In an article on the sources of design in early pottery,* Prof. Schuchhardt gives an illustration of a cord-basket from Africa, absolutely identical in shape and ornament with some of the caliciform vases of Central and Western Europe. The alternate zones of dark and light shades are most striking. In their book on the Akikuyu of British East Africa, Mr. and Mrs. Routledge give illustrations of certain string-baskets with waists, which recall certain other types of beakers. Is it possible that material for making such string-bags existed in Central Europe as well as in Spain, but that, for climatic reasons, no objects made from such materials have survived there? Or that the prototypes of beakers were made of woven leather thongs, like some which are made to-day in the Sudan?

I am glad to say that I have already made the schedules which Mr. Balfour has mentioned, and hope it may be possible to publish them with this paper. For every one of the dots on the maps I have got a line giving the site of the discovery, bibliography, present abode, and so on; and, when it was possible to obtain them, dimensions of the object and conditions of the discovery. Of course, in a large

* 'Prähistorische Zeitschrift, 1909,' pp. 37–54 (fig. 1, p. 42).

number of cases it has been impossible to discover more than the fact that a flat celt *has* been found. This collection of material, which Mr. Peake originally suggested I should undertake, was made from museums, proceedings of societies, and from all kinds of sources, but I have been careful not to include any flat celts, except those which I have seen myself or of which an illustration is given, or at least some positive evidence that it is really a flat celt and not one of a later type. While it has thus been impossible here to draw any distinction between the different types of flat celt, I have excluded all celts with a clearly defined stop-ridge, or with flanges that have been cast and not merely beaten up. This indiscriminate preliminary mapping is, I believe, quite sound in principle, since it gives one a broad outline to start upon; the detailed distribution of sub-types can then be worked out by any one with the help of the schedules. In passing I should remark that the very earliest types, such as the primitive triangular copper celt of Ireland, are not found in Britain. I have, as a matter of fact, found practically no evidence to upset the hypothesis—for such, as Mr. Balfour has said, it is—that flat celts of all types belong to different stages of a single culture period of no great length.

I should like to know upon what grounds Mr. Smith dates the gold lunulæ to about 1000 B.C. The only associated find known is that from Harlyn, in Cornwall, where two lunulæ were found with a flat celt of an early type. The evidence of the association is quite clear, and has been accepted without question by the author of the first account of its first discovery,* by Sir John Evans,† M. Reinach, ‡ Mr Coffey, § Prof. Montelius, ‖ M. Déchelette,¶ and by the author of the British Museum handbook;** and it is universally agreed that celts like the Harlyn specimen cannot be placed, at the lowest estimate, later than 1500 B.C.

I have examined the volumes of the 'Victoria County History' for notes of finds of flat celts. Unfortunately the importance of recording exact particulars of isolated finds is seldom realized by the authors of the articles on Early Man, and the descriptions of them are often so vague as to be quite useless to the student of type-distribution. In many cases (*e.g.* in the article on Early Man in the first Hampshire volume) they are entirely ignored. The maps are occasionally useful as indices.

The evidence for the discovery of beaker-fragments at Mountstewart, co. Down, rests upon a badly drawn illustration and is not accepted by Mr. Coffey. The Sligo beaker-fragments are still in existence and there appears to be no doubt of their authenticity.

I have taken all the types of beaker as belonging to a single period to which Mr. Abercromby assigns a minimum length of about 200 years. They can be roughly equated with flat celts by the association of both separately with flat tanged daggers.

Copper celts may, I think, be derived from stone celts in many regions (*e.g.* Cyprus, Hungary, Spain, Egypt, etc.), so that this line of argument will throw no light on the place of the first discovery of metal. As regards the route by which the knowledge of metal reached Britain, there is an interesting piece of evidence, a curious little blade, found at Winterbourne Bassett, in Wilts. It has three rivets and a raised mid-rib running down the middle, and it clearly belongs to a type

* Mr. Edward Smirke, *Arch. Jour.*, **22**, 1865, pp. 275–277.
† 'Ancient Bronze Implements,' p. 42.
‡ Rev. Celtique, **21**, 1900, pp. 81, 82.
§ Proc., Royal Irish Academy, **27**, 1909, p. 252.
‖ *Archæologia*, **61**, 1908, p. 128.
¶ 'Manuel,' **2**, p. 354.
** 'B. M. Guide to the Bronze Age' (1904), p. 146.

common in south-east Europe and Cyprus* (Fig. 10). It seems to me that this rare find is just what one would expect. The knowledge of metal comes first through trade intercourse in the form of one or two such precious examples manufactured in the place where metal has been discovered and mined. The knowledge at once becomes widely dispersed, and copper is mined wherever it is found under favourable conditions. The demand for ready-made objects ceases, but each people shapes the implements of the new material after the model of the old.

FIG. 10.

The mention of a beaker from Afton Down, in the Isle of Wight, is of great interest. The only other example recorded from the island is one found with a barbed flint arrow-head at Nodiam, Carisbrooke, in 1857. The Hampshire basin has always attracted invaders, but direct evidence that the beaker peoples landed there has hitherto been rare. That is mainly because the Isle of Wight—and to a less degree the opposite mainland coast—has long been archæologically in the same state as Spain. It is hoped that the foundation of a central museum at Carisbrooke Castle, and the researches thereby entailed, will do much to remove this reproach.

I imagine that the beakers must all have been made on or near the spot where they have subsequently been found. It is not at all likely that an organized trade in pottery, such as that which existed during the Roman occupation, would have been possible in the beaker period.

Captain LYONS: I am sure I may express the thanks of all who have been present at the meeting this afternoon to Mr. Crawford for his very interesting treatment of a large amount of material which throws much light on the settlements and movements of some of the early inhabitants of these islands.

(To be continued.)

REVIEWS.

EUROPE.

BRITISH VEGETATION.

'Types of British Vegetation.' By Members of the Central Committee for its Survey and Study of British Vegetation. Edited by A. G. Tansley, M.A., F.L.S., University Lecturer on Botany in the University of Cambridge. Cambridge: University Press. 1911. *Plates and Illustrations.* 6s. *net.*

THIS useful work, illustrated throughout with fine photographs, well contradicts the statement often heard that a highly scientific exposition of facts must needs be "dry" reading. The various sectional writers in it, among whom the editor, Mr. Tansley, figures prominently, have contrived to present the study of British vegetation in a new and interesting manner, always laying stress upon the influence of special types upon the scenery of the country.

* See *Wiltshire Archæological Magazine*, vol. **37** (June, 1911), plate iv., fig. 3. Similar examples have been recorded from Nant, Aveyron (Déchelette, Manuel, **2**, fig. 39), Attersee (Munro, 'Lake-dwellings,' fig. 39, No. 17), Sillein, Hungary (Pulszky, 'Kupferzeit,' p. 77, fig. 2), Cyprus (Dussaud, 'Civ. Préh.' fig. 118).

The study is developed from a standpoint not hitherto adopted in a general account of the vegetation of the country, being based not upon a statement of the distribution of species, in other words on the *flora* of the country, but upon the distribution of the different vegetation-units or plant communities, each of which has its own appropriate habitat or suitable locality with respect to conditions of soil and climate. The book begins with a general geographical description of the British islands in so far as it bears upon vegetation, proceeds to discuss the soils of the country, the existing types of vegetation, and then deals in detail with the various plant associations of the country, together with the factors which give rise to them. We are shown, for example, the characteristic differences between such somewhat closely related and similar looking formations as *moor*, *fen*, and *heath*.

The section on the "Beechwood association of the chalk," on p. 163, contains some interesting statements with regard to one of our most magnificent forest trees. It is only apparently in the south-east of England that the beech has found "climatic conditions enabling it to become dominant and to form *woods*, beating the ash, its light-demanding competitor on calcareous soils, by reason of the deep shade it casts." The beech woods of the chalk of southern England, such as the beech forests of the Chilterns in Buckinghamshire and Oxfordshire, and also to a certain extent of the North Downs, are an extension of the continental beech woods on calcareous soils, but, owing to the damper climate of England, they occupy dry chalk rather than the damper marls as abroad. The beech, of course, as a tree, flourishes and ripens seed as far north as Scotland; but it is only on the chalk of southern England that it forms natural woodland.

In connection with the general woodlands of all species, it is shown on page 70 that the south-eastern corner of England, one of the most backward parts in forestry, is by far the most richly wooded in England, the counties of Kent, Surrey, Sussex, Hampshire, and Berkshire having more than double the percentage of woodland area for England as a whole; and that the apparently well-wooded character of the Midlands as seen from the railway is due to the large number of trees in the hedgerows separating comparatively small fields, the trees and hedgerows blending to produce a false impression of woodland. Statistics thus bear out the common opinion that the flat and cultivated Midland shires are relatively tame and monotonous, and that it is to the counties south of the Thames that one must go to find the supreme beauty of England, in so far as it is manifested over hill and vale in broken stretches of wild, tangled, and knotted woodland.

This book deserves a wide circulation, for it should be as useful a guide to the general lover of nature as a book of reference to the scientific student of botanical geography; and it is not, perhaps, too much to say that all educated English people should be familiar in broad outline with their country's varied types of vegetation. L. C. W. B.

'British Plants—their Biology and Ecology.' By J. F. Bevis and H. J. Jeffery. London: Alston Rivers. 1911. Pp. xii., 334. 115 figs. 4*s.* 6*d. net.*

In this small text-book an attempt has been made to bring before the student, in a very simple and clear way, the relation between environment and plant-life. The influence of environment upon vegetation is at first discussed and illustrated by examples. The influence of the external conditions on the structure and general habit of the plant through the physiological processes is

well demonstrated, and the importance of these functions thus becomes very clear. The second part deals with the general biology of the plant individual. This is practically an elementary text-book of botany, but the greatest stress is throughout laid on the connection between habitat and type of plant, or of any particular structure. Finally, the third part deals with "The British Flora: its Evolution and Present Distribution." This is based mainly on the now numerous publications issued during the last few years by members of the "Central Committee for the Survey and Study of British Vegetation." As an elementary introduction to the subject of ecology, this little volume should prove useful to the student. O. V. D.

'Plain-Towns of Italy.' By Egerton R. Williams. (London: Smith, Elder & Co. 1912. Pp. xxiii., 603. *Illustrations and Map.* 7*s.* 6*d.*) This exhaustive monograph on Italy's "Cities of the Plain" is a useful pendant to Mr. Williams' well-known 'Hill Towns of Italy.' The work has been most conscientiously carried out, and indeed should be of great value to the art student, as it describes very elaborately places full of artistic interest but quite off the beaten track. That the author knows his Italy as intimately as Augustus Hare knew his France is easily seen. Indeed so full are his descriptions that a little pruning might be advisable. One of the best written portions of the book, and certainly the most readable, is the preface, which is singularly illuminating and suggestive. The artistic attractions of Venetia have seldom been so conscientiously and sympathetically described as in this painstaking monograph. Unfortunately the geographical features of this wonderful plain are only incidentally noticed. The index is unusually full and has been compiled with judgment.

'Rambles in Norway.' By Harold Simpson. (London: Mills & Boon. 1912. Pp. xii., 243. *Illustrations.* 6*s.*) This is a simple descriptive account of travel along well-known tourist lines. There have been others like it, but when written, as this is, with a proper enthusiasm for a beautiful subject, they are always pleasant to read. The illustrations are numerous and satisfactory, with the exception of the three-colour prints; when, for example, the author rightly describes the rock-walls of the Geiranger fiord as black; and the illustration shows them as of a reddish brown, the process must be held to fail, as it often does, to represent nature.

'Switzerland in Sunshine and Snow.' By Edmund B. d'Auvergne. (London: T. Werner Laurie. 1912. Pp. viii., 307. *Illustrations.* 12*s.* 6*d. net.*) Lovers of Switzerland may take pleasure in the light reading provided by this volume dealing with the author's own experiences and with matters descriptive and historical. He would seem to have ranged over practically the whole country, and he has gathered together some good photographs and also some illustrations in colour.

ASIA.

China.

'The New China: A Traveller's Impressions.' By Henri Borel, Official Chinese Interpreter in the Dutch East Indies. London: Fisher Unwin. 1912. 10*s.* 6*d.*

Although this highly interesting and profusely illustrated book is not geographical, it contains a variety of notes which are peculiarly instructive to those who wish to learn something of the renaissance of China, and the rapid development of its every day life since the Boxer rebellion. To us who recollect it in 1898, when it seemed to differ but slightly from the description of Cambodia by Marco Polo, it is surprising to hear of railways and telegraph lines actually

crossing Peking's ancient walls, and the Legatine Quarter entirely rebuilt in the semblance of a frowning fortress with modern ramparts, glacis, and Western artillery. All this was built with Chinese money—the four hundred and fifty millions of taels which the Chinese government had to pay as compensation after the Boxer rising of 1900. Among other civilizing agencies it is significant what an important part is played by the bioscope films or "lightning films," as they are called, which are beginning to supplant the ancient and once as popular Chinese theatre. The thousands of inhabitants of Peking and other cities are thus enabled to gain an idea of Western life and inventions of which previously they had not the slightest knowledge. Even balloon ascents and aviation trials have been thus made familiar to the Celestial ken. Among miscellaneous chapters dealing with such subjects as the streets of Peking, the Lama Temple, the funeral of the Empress Dowager, one on "Reform in China" contains some striking figures showing the expansion and increase of pupils in modern schools in the home province of Pechili alone. In the six years, 1902–1907, these have increased from 2000 to 173,352. It is clear that even the mandarins are appreciating how thoroughly the spirit of reform is in the air. As one of these officials put it to the author, "China is like a child awakened. We must teach it before it can rule itself."

'Omens and Superstitions of Southern India.' By Edgar Thurston. (London: T. Fisher Unwin. 1912. Pp. 320. *Illustrations.* 12*s.* 6*d.*) This author writes with high authority as having held the position of superintendent of the Ethnological Survey of Madras Presidency. He has previously dealt with the subject in his 'Ethnographic Notes in Southern India,' and he has also been able to draw upon his own 'Castes and Tribes of Southern India,' and on numerous scientific reports and other documents. The book, though of great length, makes curious and interesting reading.

'China in Transformation.' By A. R. Colquhoun. (London and New York: Harpers. 1912. Pp. ix., 299. *Map.* 5*s. net.*) The first edition of this book was published fourteen years ago, and events and developments during that period have necessitated ample revision, which appears to have been carefully applied. The latest statistics and details as to railways are contained in appendices, and a considerable mass of entirely new textual matter has been added.

AFRICA.

Carthage and its Surroundings.

"Twixt Sand and Sea: Sketches and Studies in North Africa.' By Cyril Fletcher Grant and L. Grant. London: Sampson, Low, Marston & Co. 1911. 21*s. net.*

In this volume the authors have given a most attractive account of the varying fortunes of those who have inhabited that portion of North Africa which lies near to the site of ancient Carthage. Commencing with the early settlement of the Phœnicians and the city of Elissar, they sketch the gods of early Carthage and their worship as it grew from the commingling of Phœnician and Libyan cults. The long struggle between Carthage and Rome is traced, and when the final subjugation of the country has been recorded, there follows an interesting chapter on the country life. The Romans faced the difficulty of a scanty water supply, and with wonderful energy constructed the numberless waterworks and aqueducts which are to be seen in their ruined state to-day, not only in the fertile plains but also on the high desolate plateaux. Inscriptions relate how a city of a hundred thousand inhabitants was supplied with water, and also private houses where now the lonely amphitheatre stands at El Djem in the midst of a desert.

The country life as well as that which went on in the towns has been amply illustrated by the discoveries which have been made in the archæological investigations which have been carried out in recent years by the French.

Late in the second century we find a vigorous and active Christian Church in this region, and its history includes violent sectarian quarrels and persecutions, while armed bands, who preyed upon friend and foe alike, frequently filled the country. All this description of a portion of the northern coast of Africa and its past history is especially interesting to the geographer on account of the successful struggle of man against the physical conditions of the country during the Roman occupation, and his complete defeat by them in later centuries when, during the invasion of the coastal lands by hordes of nomad Arabs and arabicized African tribes, the greater part of this region passed from a condition of considerable prosperity to that of semi-desert, from which a few parts are now slowly recovering. Following the historical account of the period during which north Africa has been Moslem, and the various phases of it ending with the power of the Barbary Corsairs, the second part of the volume treats of a number of special localities. Some of the ancient burial sites of the country, Biskra, the entrance to the desert wastes of the Sahara, the shrine of Sidi Okba in the desert, a desert journey to Tolga, and other subjects, provide a more geographical form of treatment than the more strictly historical character of the first part, but the whole volume is most interesting, and should be read by all those who are interested in the geography of North Africa, as it gives an instructive account of the varying conditions of political communities there, even though the geographical aspect is not very strongly brought out. This point of view would have been greatly helped by a map of the Mediterranean and another of the region round the site of Carthage, drawn on a fairly large scale; others showing the main geographical features of Algeria and Tunis would also have been welcome. The single outline map on a very small scale containing the whole of northern Africa is of no assistance in appreciating the bearings of the subject.

H. G. L.

'Cape of Adventure.' By Ian D. Colvin. (London: T. C. & E. C. Jack. 1912. Pp. xxxi., 459. *Illustrations.* 10*s.* 6*d.*) In this volume the compiler has gathered together a number of extracts from such writers as De Barros, Sir Thomas Herbert, Le Vaillant, Burchell, Nathaniel Isaacs and others—some forty in all. He has also made a collection of illustrations, including De Wit's map of the Cape of Good Hope of about 1675. He contributes a full introduction and explanatory notes at the beginning of each quotation.

'Animal Life in Africa.' By Major J. Stevenson-Hamilton. (London: Heinemann. 1912. Pp. xvii., 539. *Maps and Illustrations.* 18*s.*) The principal geographical interest of this voluminous and comprehensive work is found in maps illustrating the Ethiopian region and game preserves in various parts, and the interesting subject of gaps in the distribution of certain species. On the last subject, by means of some simple diagrams, the author shows how gazelles and the oryx, for instance, have their habitat in north and north-east Africa, and in the south and south-west, but do not appear in the intervening territories. The first chapter deals in considerable detail with the distribution and migratory tendencies of the great game animals.

AMERICA.

Physical Geography of the United States.

'Forest Physiography: Physiography of the United States and Principles of Soils in Relation to Forestry.' By Isaiah Bowman, Assistant Professor of Geography in Yale University. New York: John Wiley & Sons; London: Chapman & Hall. 1911. Pp. xxii., 759, 292 *figures and* 6 *plates*. *Price* $5.00 *or* 21*s. net.*

This important work is divided into two parts, (i.) The Soil, (ii.) The Physiography of the United States.

We suppose that part one is referred to in the somewhat obscurely worded part of the sub-title. It comprises about one-seventh part of the book and deals with the origin of soils, their physical, chemical, and thermal conditions, the supply of water and of nitrogen, the soils of arid regions and the classification of soils. It is, however, the second part which is the important portion of the book, and to it we shall confine our attention. This second and longest part aims at acquainting the "forester with the geographic basis of his work, with such references to the forest as point the direction of his more special subject." "Lest the organization of the chapters" which follow be misunderstood it is explained that "the object is to discuss not the silviculture or lumbering methods best adapted to" any forested regions, such as the Blacks Hills, "and the relations of these to the physical geography of the region, but to make the student so familiar with geography that a knowledge of it may be assumed when he begins a study of the forestry." From this it will be gathered that the book is more geographical than its title suggests. Indeed, it may be stated at once that it is the best detailed description which we possess of the physical features of the United States, as well as a most valuable account of the soils, climates, and forests of the chief "physiographic" regions.

After an introductory chapter on Physiographic Regions, twenty-five chapters are taken up with descriptions of such regions, understood as "tracts in which the topographic expression is in the main uniform. Since uniformity of topographic expression is achieved only when geologic structure, physiographic process, and stage of development in the geographic cycle are also uniform, each subdivision has an essential uniformity or unity of geologic and physiographic conditions. It is customary to speak of each subdivision as a natural region or province." That is to say, natural regions are what we would term purely geomorphological divisions. This is undoubtedly the most important characteristic of many kinds of natural regions, but it is not always that which should be selected as the determining one. The author seems to feel this in some sentences which follow, but he does not systematically apply the other tests in his classification although he considers their peculiarities in his descriptions. The classification of climatic and biological regions in the "Zone map of North America" which forms the frontispiece is very inadequate, for it shows most of the west coast of Vancouver island as identical with that of the region round Winnipeg and parts of the Great Basin as similar to the country round Chesapeake bay!

Such criticisms would be of importance in any general discussion of the classification and distribution of the larger natural regions of North America, but in the present case they are of less importance, as the regions which are described in detail are sufficiently small to allow them to be selected according to the prevailing type of land form. As an example of the method adopted we may examine one of the chapters more closely.

Chapter 24 deals with the Prairie Plains. First comes a description of their extent—the greater part of the middle west, from the Laurentian lakes to the

Ozark, from the Great Plains to the Appalachian plateaus. They form a rolling country thinly timbered in the drier west, but much thicker in the wetter east, where, however, the clearings are very extensive and little primeval forest is left. Coniferous forests exist in the north, but the forests of the southern two-thirds are hard-wood. "There is good reason for believing that were the surface less flat, the absorption of rain-water less pronounced, the original forest would have been much more restricted." The general characteristics of these prairies are described. Then the most general topographical feature of the Prairie Plains, the Tertiary Peneplain, is traced and analyzed. Such a statement as: "the valley topography is a feature of the present cycle of erosion; the inter-valley topography exhibits many characters inherited from the preceding cycle of erosion in which a peneplain has formed," shows how the point of view and interest of the morphologist rather than of the forester dominate the book and makes it all the more useful to the geographer. Part of the plain is covered with glacial deposits, and an account of them is given in sections on the centres of glaciation and on glacial and inter-glacial periods in the Middle West where six advances of the ice are recognized. The topography of the glaciated area is described generally, then the "terminal moraines and till sheets," the drainage modifications, the lake plains and the "pre-glacial" lakes. Next follow accounts of the soils of the glaciated country, the loess deposits, the tree growth of the prairies, distinguished by having a continuous sod, dotted with groves of trees, from the plains with grasses in clumps and "without timber except along the streams, on prominent elevations and in places about springs." Finally, there is a section on the 10,000 square miles of Driftless Area inside the glaciated one.

The photographs and sketch maps are admirable and will be found of as great use to the morphologist as to the student of forestry.

The work is one of the most valuable of contributions to the descriptive physical geography of the United States. It summarizes the innumerable special studies which are the despair of the European, who has also to concern himself with other parts of the World; and the references in the footnotes allow him to turn to the original memoir in case he wishes to have fuller information about any region. We commend it to all who have to study North America.

There is one point to which a passing reference may be permitted. The book is most carefully compiled and written, and we take it that all differences in terminology, of which there are a considerable number (*e.g.* peneplanation for base-levelling, etc.), and the deviations from standard English as it is written at home are due to a different usage in America. This difference will be noticed in some of the passages cited. A. J. H.

'A Woman's Winter in South America.' By Charlotte Cameron. (London: Stanley Paul. 1912. Pp. 292. *Illustrations.*) This is a narrative of travel along pretty well known lines in South America, and to say truth, it is in parts somewhat commonplace, though it contains many useful hints to travellers. It is unfortunate in being rather indifferently produced and illustrated.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Two Books on Surveying.

'Geodetic Surveying.' By E. L. Ingram, C.E. New York: McGraw-Hill Book Co. 1911.

'Plane Surveying.' By P. C. Nugent, A.M., C.E. 3rd edit. New York: J. Wiley & Sons (London: Chapman & Hall). 1911. 15*s. net.*

All who undertake the survey of lands which occupy a considerable area need something more than is furnished by the ordinary instruction in plane surveying.

For the civil engineering students of the University of Pennsylvania Prof. E. L. Ingram has prepared a Manual of Geodetic Surveying, using this expression to include all those cases in which the land surface, on which the measurements are made, is considered as a portion of a sphere or a spheroid. The book is divided into two parts, of which the first treats of instruments and methods of work, while the second deals with the mathematical treatment of the observations for their adjustment and correction in order to obtain the most reliable and concordant values. An introductory chapter deals with the principles of triangulation, and briefly describes the more usual types of network, the effects of curvature and refraction, and the marking and preparation of stations. Base-line measurement forms the subject of a chapter on which the Eimbeck apparatus, steel tapes, invar tapes, etc., are described, and the various corrections necessary to obtain the true length of a geodetic base are discussed. Angular measurements with micrometer theodolites are dealt with, and instructions are given for the normal method of taking a series of observations from a station and for determining the probable error of an angle. This leads us on to the adjustments and computations of a triangulation, and to the computation of geodetic positions. Geodetic (or precise) levelling is discussed after a short account of trigonometrical levelling, and the Coast Survey pattern of level, and the rods, etc., there used are described. The explanations throughout are clear, and the formulæ for each operation are carefully discussed, but though numerical examples are frequently given it would be a valuable addition if the actual reduction of a base-line, the computation of a triangulation polygon, etc., were also presented in full, from which the student would gain a clearer idea of these operations. Full examples of this kind are given in the chapter on Astronomical Determinations, and they might usefully be employed in the geodetic portion. The second part of the book is allotted to more mathematical subjects, and deals very fully with the adjustment of observations by the method of least squares, special chapters being devoted to its application to angular measurements, to the reduction of base-line measurements, and to levelling. The book is well designed to meet the purpose of those for whom it has been written, and will also be useful to more experienced workers, though they would probably be glad to have references to the more important literature of the subject, which is seldom quoted.

Mr. Nugent's manual deals very fully with those simpler portions of the subject in which the area measured is sufficiently small to be treated as a plane surface. This is taken to be true of areas up to 100 square miles. Chain surveying and the employment of the compass is thoroughly dealt with, and the formulæ setting forth the nature and magnitude of the errors involved in any operation are given and discussed. A useful chapter treats of the telescopes employed in the principal surveying instruments and the optical principles which are involved in their construction and use. Spirit-levelling and the determination of section lines by the aid of the mercurial barometer and of the aneroid is explained; but the determination of altitudes by triangulation is briefly referred to, except in so far as the principle is employed in mine surveying. As important aids to modern surveying, the use of planimeters of various types and of slide-rules is fully explained; but in view of their increasing employment wherever much computation has to be undertaken, a short account of some recent computing machines might profitably have been included. Hydrographical surveying is very briefly treated, and a reference to works dealing more especially with this branch might be added. Mine surveying occupies a chapter, and the survey of

public lands, together with the use of the solar attachment, is fully discussed as being of especial importance to those trained as surveyors in the United States. An appendix taken from the Report of the U.S. Coast and Geodetic Survey, 1897, discusses the principles of photogrammetric surveys, and describes some of the instruments in use.

The whole volume forms a useful and well-arranged handbook of surveying, as it has developed in response to the conditions which prevail in the United States, and contains much that will also be of interest to those whose work lies in other regions. H. G. L.

GENERAL.

'The Association of History and Geography.' By A. J. Berry. (London: Blackie. 1911. Pp. x., 171. 1*s.* 6*d.*) This book consists of a series of short notes and essays on various subjects, so treated as to illustrate the connection between history and geography. Some of these notes are commendable on account of the judicious handling of subjects, such as etymology, which easily become obscure if their technical difficulties are allowed to intrude; in Mr. Berry's notes they do not do so. There are occasional general statements which are possibly open to misconstruction. Thus, the sea was far less valuable to the Romans as a bond between the various parts of their empire than their overland connections, but here the sea is given the first place. And, again, the Sahara is surely not only as effectual a barrier to communication as the ocean, but much more so.

'The Rubber Industry.' Edited by W. T. Torrey and M. S. Manders. (London: International Rubber Exhibition, Ltd. Pp. 470. 15*s.* 6*d.*) This is an official report of the proceedings of the International Congress held in London last year. The first section of the collection of papers is of principal interest to geographers, as it deals with the problem of rubber plantation in different countries. From this collection it is possible to learn much of these problems and other differences as between one country and another, from papers by authorities interested in the rubber production of Uganda, Madagascar, West Africa, the West Indies, the Amazon region, and parts of south-eastern Asia. For the rest the volume is concerned with technical details of the treatment of rubber plants and of the raw product, as well as of the trade in rubber.

'Clarendon Geography.' Vol. 1. By F. D. Herbertson. (Oxford: Clarendon Press. 1912. Pp. viii., 379. *Maps and Illustrations.* 3*s.*) This text-book is divided into three parts, the first dealing with the principles of geography in general, the second with the British Isles, and the third with Europe. It has the merit of being readable in the sense that many text-books are not; while at the same time it does not on any point become discursive or tend to omit necessary facts. The diagrams and illustrations are numerous, and have been undoubtedly much improved since the earlier Oxford geographies. A limited number of exercises are provided, and statistics are furnished with judicious brevity, and separately from the text. Certain paragraphs which are not intended for the less advanced pupils are carefully distinguished from the bulk by being printed in smaller type. The maps include two in colour, attached to the covers, representing the relief of the land in the British Isles and in Europe. The colour of the latter map is astonishingly gay.

'The World.' Longman's Geographical Series. Book 3. (London: Longmans, Green & Co. 1912. Pp. x., 613. *Maps, Diagrams and Illustrations.* 4*s.* 6*d.*) This volume has been partly re-written and enlarged to meet modern requirements. It resembles rather a reference book than a class-book, for it contains certain particulars, as on government, religion and education, which

are hardly necessary to the teaching of geography; also the book will probably be found difficult to read by many, as there are few pages on which there are not four or more different styles of type, and the smallest of them is very small. There is a large number of maps, including many in colour, and some of these are nothing more than simple atlas maps on a small scale; however, their presence is no doubt a convenience. The text is to a great part tabular in style, and appears to be accurate in the great mass of facts it presents.

THE MONTHLY RECORD.

EUROPE.

Forest and Settlement in Ancient Germany.—An inquiry which is still in its early stages is that of the distribution of ancient settlements in countries like Germany. It has there been taken up by one or two investigators, particularly by Dr. Otto Schlüter, who is recognized as a foremost authority on the geography of settlements. He has for some time been attempting to reconstruct what he calls the "primitive landscape" of Germany, though, as it is impossible to obtain data for the very earliest distribution of human settlements, we must be content to ascertain the state of things at an early historical period. In a reprint from the *Mitteilungen der Naturforschenden Gesellschaft zu Halle a.d. S.* (vol. 1, 1911), Dr. Schlüter briefly describes his methods and preliminary results. The chief sources of evidence are: (1) place-names; (2) antiquarian finds; (3) the nature of the soil, the character of the natural vegetation, and, in a measure, the climatic conditions. The second of these would, of course, be the most important, were it not for the defective nature of the data yet available. It is, therefore, necessary to rely a good deal on the evidence of place-names, which, taken in conjunction with the other two groups, may, Dr. Schlüter finds, at least permit the main features of the distribution of forest and settlement to be ascertained. Some place-names at once point to the former existence of forest, either directly or as indicating that clearing has taken place. Others by their mere geographical distribution give an indication of the localities that were early free from forest. For the eastern half of Germany the Slav occupation is of importance, for, as the Slavs did little in the way of clearing, it holds in general that the older settlements are represented by Slav, the later by German, names. The epoch for which Dr. Schlüter has attempted a reconstruction of the map is that of about A.D. 500, a date preceding the great clearings from the sixth to the ninth centuries, while the state of things then obtaining may be considered more or less typical of a long anterior period, apart from the episode of the Roman occupation. The result of the study is to confirm the view of other recent investigators that the extent of settlement in early times was greater than was once supposed, and to bring out the close dependence of the distribution on geographical factors. Thus the later morainic zone in the Alpine foreland was mainly forested, while the loess of the upper Rhine valley and elsewhere was early settled. The Muschelkalk between the Black forest and the Odenwald gave rise to a string of settlements, representing an important early line of communications, while the Keuper further east was forest-clad. Bohemia was mainly forested, though the loess of its lowest portion was the site of extensive settlements. In western Silesia and eastern Saxony forests were almost continuous, but west of the Elbe we come to the largest continuous area of early settlement in the whole of central Europe, as is well brought out by Dr. Schlüter's map. It embraced the lowlands round Leipzig and Dresden, as well as the Thuringian basin, with an

extension round the eastern end of the Harz right up to Hanover. Dr. Schlüter is continuing his studies, and will eventually publish more detailed results.

"Transhumance" in Southern France.—A study of the annual migrations of sheep between the winter and summer feeding grounds in the Montpellier region, on the lines of similar inquiries elsewhere by MM. de Martonne, Fribourg, and others (cf. *Journal*, vol. **36**, p. 490), is contributed by M. Max Sorre to the *Bulletin* of the Languedoc Geographical Society, Premier trimestre, 1912. A preliminary inquiry into the physical character of the region studied (which extends from the coastal plain to the foot of the Cevennes, without including the central portion of the latter) shows how that character, while assigning a natural place in the rural economy to the pastoral industry, at the same time makes it dependent on the practice of "transhumance." In spite of the relatively high annual precipitation (710 mm. or 28 inches), the region must be classed as a dry one. In summer the temperature is high and the evaporation great, while in winter and spring the *mistral* frequently neutralizes the benefits of the rains. Vegetation rests in summer rather than in winter—a state of things unfavourable to the growth of fodder—and meadows can only exist where the soil is able to store the water-supply for their use. In parts, even of the upper levels, where the rainfall increases, the nature of the soil is unpropitious, and there are large areas which will support little but the evergreen oak or the "garigue" (scrub) which follows from its destruction. On the other hand, though a large area is incapable of agricultural development, the portions of the surface occupied by heaths, brushwood, and the like, are not to be classed as useless. They are, in fact, indispensable to the flocks, which are alone capable of transforming them into productive soils. In the plain, even the parts given over to the vine are at the disposal of the flocks during winter. During the heats of summer, however, it is necessary for the most part for them to be taken to the mountain pastures, and thus has arisen the annual migration which has always formed an integral part of the rural economy of Lower Languedoc. M. Sorre discusses the pastoral industry in general and the conditions of "transhumance" in particular, from an historical point of view, and ends by tracing the main lines of the "drailles" * or drove-roads, so far as it is possible to reconstruct them at the present day. (For this purpose he has made a personal exploration of the ground, besides using other sources of information.) Three trunk routes can be made out, which are again linked together by secondary lines, the foci being important collecting points for the flocks. The principal axis coincides in part with the old road from Montpellier to Ganges, and it is an interesting question which of the two is the older in this section. There are certain indications that a previously existing drove-road may have here determined the trace of the modern road, though it is possible, on the other hand, that the flocks may have been diverted from their earlier course by the making of the modern road. At the present day the drove-roads have to a large extent degenerated into mere tracks, and, as in the case of Spain, the signs of impending change are to be seen in the use of the railway for the transport of flocks to their summer pastures.

ASIA.

Native Suspension Bridge over the Dihong.—The skill displayed by native races in the construction of rope or cane bridges for the crossing of rivers in many of the tropical and subtropical regions of the world, has long been known from the reports of travellers. An unusually fine example of such a bridge, thrown by the Abors across the Dihong 8 miles north of Kebang as

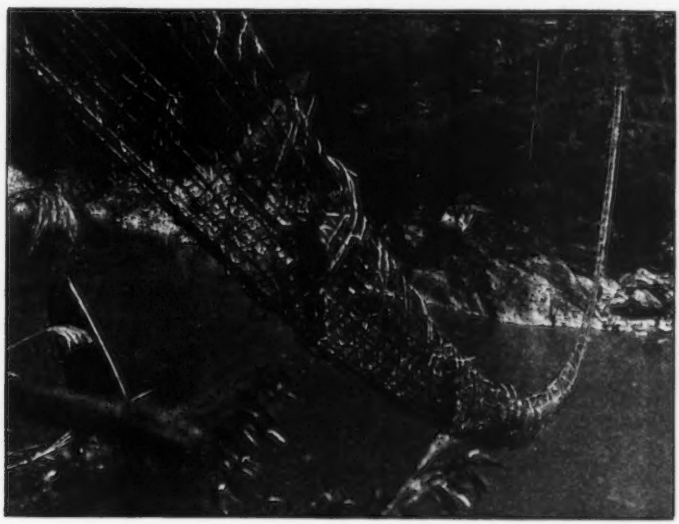
* The origin of this local term is obscure.

a means of communication between villages on either side, is the subject of a minute description, illustrated by a series of photographs, sent us by Captain J. S. O'Neill, who took part in the recent Abor expedition. The Dihong at this spot has a considerable width, and the length of the bridge, measured along its curve, was found to be 717 feet from bank to bank; while, with the approaches on either side, the total reached 786 feet or 262 yards. When visited (March 6, 1912) the height above the water at the centre, measured from the footway, was just under 50 feet, and the height of the supports on either side was 130 feet above the water-level. As shown by the photographs here reproduced,

LOOKING DOWN FOOTWAY FROM SUPPORTS, PONGING SIDE. ABORS CROSSING WITH THEIR "TALIS" (BASKETS).

the structure has the form of a long tube or cage of interlacing canes, and it is supported on either bank by huge posts with a maximum length of some 25 feet, supported by buttresses, and with cross-beams firmly secured by lashings of cane and creeper. The anchorage is by long strands of split cane attached to growing trees, rocks, etc., and the main cables consist of six strands of split cane twisted, the individual canes—varying in length from 20 to 50 feet—being joined end to end by very careful loop-binding of fine cane, some thirty strands being interlaced and firmly bound. The long tubular cage forming the body of the bridge is composed of thirty strands of split cane, running longitudinally at intervals of from 6½ inches to a foot, and bound together by thinner strips interlacing crosswise. At varying intervals there are complete hoops of

cane (numbering fifty-nine in all), made of four strands of whole cane twisted, while ten cross struts of bamboo keep the upper cables apart. The roadway consists of the longitudinal strands of cane, varying in number and proximity to each other, but the main weight of the body is supported by grasping the upper cables. The natives usually cross two at a time, but Captain O'Neill saw as many as five crossing at once. There is a certain amount of give at each step (from 9 inches to a foot), and towards the centre, especially if one attempts to cross quickly, there is a good deal of lateral swing. The Abors stated that the whole work was completed in about a month, about two hundred men being engaged on the construction, hailing from seven villages on the right and five on the left bank. The cane, procured from the jungle near Yekshi, was brought in two days, and in four more the logs were cut and erected. The strands were prepared on the river-bank for the complete length of the bridge,



VIEW OF BRIDGE FROM RIGHT BANK. KOMSING ABORS CROSSING.

and were taken across one after another on rafts, the men working from both sides of the river.

AFRICA.

Expedition into the Eastern Desert of Egypt.—Continuing the work carried out in 1910, Dr. W. F. Hume last year undertook a new expedition into the desert east and south-east of Assiut, between the Nile and Wadi Kena, which until two years ago had been a blank on our maps. It led to interesting results, both topographically and geologically, which are described in the *Cairo Scientific Journal* for April, 1912. In 1910 it had been found that nearly all the great valleys which descend to the Nile and Wadi Kena have their source in a high plateau of limited area close to the limestone desert which overlooks Wadi Kena. In 1911 it was proved that Wadi Habib, which enters the great expanse east of Assiut marked Wadi Assiut on the maps, also heads in the immediate neighbourhood of a branch of Wadi Kena. Five different Wadis thus

originate in this high region, cutting their way rapidly down through the softer limestone strata which constitute the upper portion of the Lower Eocene. On entering a series of biscuit-coloured cavernous and flint-banded limestones which form the lower member of that formation, they give rise to fine ravines, with vertical walls 300 feet and more in height. These narrow and deep-cut valleys are the characteristic feature of this area. Geologically the upper and lower series present a sharp contrast, the upper being rich in fossils, which can be collected in a wonderfully preserved state on the very summit of the limestone desert; while the lower, on the contrary, are without fossils, and the limestones are either compact and cavernous, or seamed with regular bands of flint. The latter are particularly liable to erosion by water, the temporary streams forming underground channels, whose waters are preserved under favourable conditions in the sands or as pools at the foot of the clefts through which they are poured. The investigation of the water supply was one of the objects kept in view. The depth of the valleys and the shade of the overhanging rocks are particularly favourable to the conservation of water, though, owing to the rarity of the rains, the pools are seldom available for any length of time. Only four are of real value, the most important and interesting being a beautifully pure pool lying in a vertical-sided groove in Wadi Sheitun. Another spacious pool, visited for the first time by Dr. Hume's party, lies in Wadi Um el Abbas, one of many stony valleys which open into the great Gurdi ravine (draining to Wadi Kena). Dr. Hume was accompanied by Lieut. Davidsen, of the Danish Technical Artillery, who was well provided with altimetric instruments of various kinds, and took careful observations throughout, including records of air-temperatures and humidity, and of the temperatures of the various rock-surfaces, etc. He also made careful investigations of the distribution and conditions of life of the plants of this desert area.

The Italian-Abyssinian Frontier in Somaliland.—The Italian Commission for the survey of the frontier of Italian Somaliland with Abyssinia returned to Italy in January, and some account of its operations is given in the *Revista Geografica Italiana* (1912, No. 1). The leader was Captain Carlo Citerni, one of the survivors of Bottego's last expedition, who was supported by Dr. B. Colonna as medical officer, and by Signors Grupelli and Venturi as topographers. The expedition set out towards the end of 1910, travelling from Jibuti to Adis Ababa, whence it was to strike south-east through an imperfectly known country to Dolo on the upper Jub, a little above Lugh. Here the survey of the frontier was to begin. During the stay at Adis Ababa a topographical survey of about 12 square miles was carried out on the scale of 1 : 25,000, embracing the city and its environs. The march to Dolo led by the Lagio pass from the basin of the Hawash into that of the Web, across a mountain range with summits reaching 13,000 feet and more. At Dolo observations for latitude, longitude, and azimuth were taken and a base measured, after which a triangulation was carried out along the frontier zone to the north-east and a survey plotted on the scale of 1 : 100,000. This region had hitherto been almost a blank on the map. The work does not seem to have been continued beyond the Webi Shebeli, but on reaching this the Commission returned to the coast at Brava. Besides the precise survey of the frontier, a careful traverse of the whole route from Dire Dawa (near Harrar) to Brava was carried out, and numerous astronomical determinations of latitude and longitude were made.

Lakes of the Kamerun.—The tasks laid down for the Kamerun expedition of 1907–08, under Profs. Hassert and Thorbecke, to which reference was made at the time in the *Journal*, included an investigation of the lakes of that region,

the results of which have been recorded by Prof. Hassert in the first three numbers of the *Zeitschrift* of the Berlin Geographical Society for this year. Almost all the known lakes of the Kamerun lie in a zone of tectonic disturbance running through the northern part of the territory from south-south-west to north-north-east. It is marked by occurrence of recent volcanic formations in the form of sheets of basalt and trachyte, or of volcanic peaks, cones, or domes. With the exception of two, all the lakes of this zone are likewise of volcanic origin, being either crater-lakes proper, or the crater-like formations known to the Germans as "Maare." Eight were sounded by Prof. Hassert, and three more visited though not sounded. The work was carried out from a folding boat, with the help of a native rower, by means of a Belloc sounding apparatus, which proved extremely efficient. The lines of soundings were so arranged as to cover as much of the area as possible, and the positions of each measurement were fixed, in general, by counting the strokes of the oars, care being taken to keep the boat on the correct line between the terminal points. Although the conditions under which such work can be carried on in a new country makes absolute accuracy unattainable, Dr. Hassert considers that his results give a correct general representation of the features of the lakes. As might be expected from their origin, they are roundish or oval in outline, and, with one exception, are bounded by steep slopes, both above and below the water-line, falling to a more or less level floor. The catchment areas are naturally small, and the streams which feed them unimportant, the crater walls mostly forming the water-parting. The lakes, therefore, depend for their water-supply chiefly on the rain falling on their surface, and the variations of level are thus great, and in some cases clearly marked on the bounding walls. Occasionally traces of a higher water-level not reached for many years were discernible. The crater walls are but slightly breached by the outflowing streams, which often dry up entirely in the dry season. Prof. Hassert gives a detailed description of each of the lakes examined by him, the largest being the Elephant lake with an area of $4\frac{1}{2}$ sq. kilometres ($1\frac{3}{4}$ sq. mile), the deepest the Great Ndu lake, with a depth of over 208 metres (682 feet), though the frequent losses of sounding wire prevented the maximum from being determined. The most remarkable are, however, the Great and Little Epocha lakes, which, though of very small size, have depths of 163·2 and 92·9 metres respectively (535 and 305 feet); the average slope of their shores reaching the high figures of 35·5° and 49·5°. Observations of colour and transparency (both varying greatly) were taken, as also of surface temperature (complete temperature series being impossible owing to the failure of the thermometer). The surface temperature was generally as warm or warmer than that of the air.

AMERICA.

Mountaineering in Alaska.—Alaska offers a field for mountaineers which, apart from Mount St. Elias and Mount McKinley, has hardly been touched down to the present, partly, no doubt, owing to the unusual difficulties arising from the low level of the snow and tree lines, and other causes. A lady's venturesome expedition to Mount Blackburn, one of highest summits of the Wrangel group (16,140 feet), is described in *Appalachia* for April of this year. The completion of the Copper River Railway, in April 1911, for the first time supplied a means of easy access to within 35 miles of the Wrangel mountains, and of this Miss D. Keen took advantage during a visit to Alaska last summer. She was fortunate in securing the services as guide of a well-known prospector, Mr. R. F. McClellan, and the party was made up by three other members of the same hardy fraternity. For part of the way a German Alpinist, Herr Wolf,

also took part in the journey. Supplies for a limited time only could be taken, and this fact eventually necessitated a return before the ascent of Mount Blackburn had been completed, though not, apparently, before the chief difficulties had been overcome. The route from the head of the railway, south-east of the mountain, up the 3-mile-wide Kennecott glacier, was adopted. Going proved unusually difficult, the abnormal heat having left the glacier bare of snow, and the countless crevasses gave much trouble. The head of this glacier was reached by the end of the fourth day, but nearly five more days were then wasted in trying routes up glaciers that proved too dangerous, the snow and ice being everywhere treacherous from the heat, and avalanches constant throughout the greater part of the twenty-four hours. On the tenth day a feasible route was at length found, and it was thought that, with two or three days' favourable weather, the summit could have been reached. But a bad snowstorm setting in, and the supplies being almost exhausted, it was necessary to turn back without delay.

Afforestation in the American Prairies.—In a recent Academic dissertation (Munich University, 1911), Dr. H. P. Baker discusses the difficult question of the cause of the treelessness of the American prairies, and the possibility of the development of scientific forestry in this part of the United States. It is based both on the writer's own investigations extending over several years, and on a study on the previous literature on the subject. The paper begins with a consideration of the physical characteristics of the prairies proper, which Dr. Baker shows to be frequently confused with neighbouring areas more properly to be grouped with the "plains." The conditions of relief, soil, and climate are in turn discussed, stress being laid on the undulating nature of the surface; the finely comminuted soil, composed, especially in the north, largely of drift and loess, and showing great resemblances with the "black earth" of Russia; the decrease in the rainfall towards the north and west, and the great variations in the amount from year to year; the suddenness of the transitions between winter and summer; and, lastly, on the *régime* of the winds, which, except in the spring and early summer, are generally dry, and are thus, whether cold (as in winter) or hot (as in summer), unfavourable to tree-growth. The true limits of the prairies are determined by the lines of equal rainfall, that of 38 centimetres (15 inches) being regarded as forming the dividing line with the plains on the west. As the rainfall lines in this part take a generally north-and-south direction, the meridian of 100° W. may also be regarded as constituting the western prairie limit. As to the causes of the treelessness, Dr. Baker declines to accept the nature of the soil as dominating the question, holding to the view that the whole area in question was once forest-clad. He thinks that much weight must be given also to the effects of fire and of unfavourable climatic conditions. It is, in his view, to the *combined* action of all these factors that the result is to be ascribed, no one cause being sufficiently powerful in itself to prevent the growth of forests. He thus believes that suitable measures, especially in the direction of protection from fire and the use of suitable species of trees as wind screens, should permit of successful forestry in this region, even though the natural conditions may not be so favourable as in the states east of the Mississippi. Favourable points are the nearness of the markets, the accessibility of the region, and the absence of topographical difficulties.

Gravity Anomalies and Geological Formations in the United States.—The results of an investigation of the relations existing between the observed values of gravity anomalies at 124 stations throughout the United States, and the geological formations in which the stations occur, are put forward by Mr.

W. Bowie in the *American Journal of Science* for March last. The anomaly of gravity adopted for the purpose was the difference between the observed gravity and the theoretic gravity for the latitude of the station, corrected for elevation and for the effect of the topography and its isostatic compensation. It is, of course, practically certain that the assumptions made for the calculation of these corrections, *e.g.* that the isostatic compensation of the topography is complete and uniformly distributed to a depth of 114 kilometers, do not actually hold good, but the gravity operations prove that the average condition over areas of large extent approximates very closely with that assumed, and show that neither the United States as a whole, nor any portion as large as the State of Ohio, is held up by the rigidity of the Earth's crust. The comparison of the amounts of the gravity anomalies with the various geological formations (classed according to age) shows a comparatively large *plus* mean anomaly in the case of the oldest formation, and a decided *minus* anomaly in the case of the most recent; the anomalies for the intermediate formations being practically normal. This was only to be expected, since the densities of the older rocks are on the average greater, and those of the newer less than the average surface density, which, for the purpose of the computations, was taken as 2·67. Mr. Bowie shows, however, that these cannot be mere surface phenomena, but that, under the assumptions stated, large changes in the normal densities are necessary, even in thick strata, to account for gravity anomalies of average size. On the other hand, only small changes in density are necessary, if we suppose a departure from the state of perfect isostasy in the Earth's crust. It is highly probable that such a departure is actually the principal cause of the facts observed, though changes in the density no doubt play their part also.

AUSTRALASIA AND PACIFIC ISLANDS.

Desert Water-holes in Western Australia.—In the July number of the *Geological Magazine*, Dr. Malcolm Maclaren describes some occasional sources of water-supply in the granite-gneiss areas of the Western Australian deserts. In the summer, when the waters of the greenstone-schists that traverse the country from north-north-west to south-south-east are even salter than those of the sea, the granitic areas afford the only available supply. Failing the usual "soaks," found in sandy hollows at the foot of granite slopes, it is necessary to search the bare rock outcrops for rock-holes, or "gnamma" as they are called by the natives. The normal form is that of a water carafe, with a narrow cylindrical orifice and wide cavity below; and the capacity may reach even thousands of gallons. They apparently arise in the first instance from the flaking off by insolation of small fragments along the walls of joints in the granite. Water lodges in the cavity, decomposing the felspathic constituents and allowing the quartz-grains to be carried away by the desert winds. The cavity is enlarged, whereas the orifice is protected by being raised above the standing water, but still more because of the siliceous cementation that has taken place at and near the rock-surface. A more remarkable form of water-hole is that of the "night-wells"—dry by day, but furnishing an abundant supply by night—which are regarded as mysterious and even somewhat uncanny, since their flow is preceded by weird hissings and sounds of rushing air. Only one of these could be definitely located by Dr. Maclaren, but from his examination of this he puts forward a plausible theory of the principle of the phenomenon. Here the water-supply occurred in a long narrow trench, determined by parallel joint-planes. Near the bottom of this there was a horizontal rift separating a thin surface-plate of gneiss from the main mass. This shell is subject to a great diurnal range of temperature, and

being prevented from horizontal expansion on three sides, must form an arch when heated, allowing the water in the trench to retreat into the cavity so formed. Contracting at night, it forces first air and afterwards water back into the trench. Since the linear expansion of gneiss is only about one part in 200,000 for every degree Fahrenheit, the cavity must be large to admit of the observed effect.

The German Kaiserin Augusta River Expedition.—Various reports on the progress of this expedition (*Journal*, vol. **38**, p. 537; vol. **39**, p. 493) have been received in Germany. After reaching New Guinea and completing the final preparations at Friedrich Wilhelms Hafen, the expedition started for the scene of its labours on February 28 in the steamer *Komet*, the *Kolonialgesellschaft* remaining behind to wait for a pinnace from Hong-kong. Entering the Kaiserin Augusta river, the expedition formed its base camp at a point 240 nautical miles from its mouth, on the slopes of the Hunstein range, near the native village of Malu. During the preparations of a flotilla for the further ascent of the river, scientific observations and explorations in the neighbourhood of the camp had been carried out. The latest news, dated May 15, is that a section of the expedition had established a second station 85 miles higher up.

POLAR REGIONS.

New Projects for Arctic Exploration.—Attention is again being directed to the sea-route to Siberia as a field for exploration. An elaborate expedition is being organized in Germany by Lieut. Schröder-Stranz, whose original intention of carrying out a voyage of research to Novaya Zemlya and the Taimur peninsula has now given place to a proposed complete circumnavigation of Northern Europe and Asia, repeating the classic achievement of Nordenskjöld in the *Vega* (*Petermanns Mitteilungen*, July, 1912, p. 34). Lieut. Schröder-Stranz is not, however, desirous of merely once more achieving the passage after an interval of thirty-four years, but hopes to carry out extensive scientific researches during the voyage, which is expected to last from three to four years. On the Russian side, it appears that Mr. Russanof, who has many times visited the Novaya Zemlya region (*Journal*, vol. **39**, p. 80), is once more planning an expedition to that country, with a view to further testing the possibilities of navigation to Siberia round its northern end. He will be accompanied by Mr. Kuchin as hydrographer. On the other hand, it is said (*Petermanns Mitteilungen*, May, 1912, p. 280) that the opening of a sea-way to Siberia from the west does not find favour with the Russian authorities, who, however, are continuing their efforts to open regular navigation from Bering sea to the Kolyma and Lena rivers. The mouth of the former river is to be surveyed by Captain Grünfeld, who has already started from Yakutsk for the purpose, while the stretch of coast-water between the Kolyma and Lena is to be investigated by the well-known geologist, J. P. Tolmachef. A good deal has been heard of a proposed Russian expedition to the North Pole, under Lieut. Sedof, who has already undertaken minor expeditions to Northern Siberia and Novaya Zemlya. Sedof's plan appears to be to proceed to Franz Josef Land, and thence make a sledge journey across the pole to Northern Greenland. It is reported, however, that the hoped-for support of the Russian Government is not likely to be afforded, and the venture must rely on private assistance only. On the Greenland side, it appears that the explorer Rasmussen is this year prosecuting his plan, abandoned last year from force of adverse circumstances, of searching for traces of the missing Danish explorer, Einar Mikkelsen.

The Japanese Antarctic Expedition.—The *Kainan Maru*, with Lieut. Shirase's expedition on board, reached Yokohama on June 19. According to

information reproduced in *Petermanns Mitteilungen*, July, 1912, the stay of the party on the Antarctic continent lasted scarcely four weeks. Landing on January 16 at Whales bay, Shirase started on a trip to the interior on the 20th, returning on February 1. Meanwhile the ship went east along the coast of King Edward VII. Land to Biscoe bay, where Alexandra peak was climbed. A sledge party under Takeda went south-east to 156° 27′ W., 80° 5′ S., where the altitude of 1300 feet was reached. It is stated that Shirase claims to have disproved the connection of King Edward VII. Land with South Victoria Land.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Distribution of Electrical Conductivity of the Atmosphere over the Pacific.—The observations secured during the voyage of the *Galilee* in 1907–8 have permitted general conclusions to be drawn as to the variations of electrical conductivity of the atmosphere over the Pacific, as is done by Dr. A. Nippoldt in *Terrestrial Magnetism* for March of this year (vol. 17, No. 1). The subject has a distinct geographical interest by reason of the close connection which is brought out between the variations of conductivity and the distribution of land and water. The values having been worked out for the whole area covered by the observations, for fields of ten degrees in each direction, it was found that, whereas no law was traceable in the variations in longitude, in latitude a regular diminution from north and south was apparent. This was the case both for the data as a whole and also when the results were considered separately for the eastern and western halves of the area. The cause that at once suggested itself was the corresponding diminution of the land-covering of the globe in the same direction, and on comparing Heiderich's figures for the land-content of different zones of latitude in the western hemisphere, and still more on reckoning the same for the hemisphere more nearly corresponding with the Pacific ocean, a certain agreement was found to exist, though systematic deviations were still observable. In the northern hemisphere the actual figures for conductivity were generally in excess of the theoretic values based on the distribution of land, while in the southern the reverse was the case. In the north the land appears to exercise a more powerful influence (because nearer) than in the south. In order to fully investigate the relation, it would be necessary to take account of the distance from land of each separate point of observation, and this not in a direct line, but along the course of the prevailing winds. There seems no doubt, however, that in the case of the Pacific the main factor is the varying proportion of land to sea in different latitudes. The regular outline of this ocean favours the operation of this law, which is hardly traceable in the observations so far secured from the other great oceans.

GENERAL.

Vespucci as a Discoverer and Cosmographer.—To the many studies of the voyages and geographical contributions of the Florentine navigator, Mr. Henry Vignaud has added yet another, in a paper printed in the *Journal de la Société des Américanistes de Paris* for 1911. While forming a convenient summary of the existing data on the subject, it is at the same time written with the evident aim of putting the case for Vespucci in as favourable a light as possible. No doubt much that M. Vignaud advances is sound, for the criticism to which the navigator has been subjected in the past has been largely based on imperfect information, and has been unduly depreciatory. On the other hand, he shows throughout a corresponding bias in Vespucci's favour (coupled with his customary disposition to depreciate Columbus), which leads him sometimes to minimize the force of adverse arguments. Thus, while admitting that many

inaccuracies must exist in the "Letters," and not hesitating to discard any statement which it is difficult to substantiate, he presses to the utmost anything in them that tells in favour of the claims raised. This is especially the case in regard to the supposed first voyage, which he not only has no hesitation in accepting as authentic, but which he believes to have resulted in the discovery of an enormous stretch of the North American coast. The general result of the study is to exalt the Florentine to an almost unique position among his contemporaries both as a discoverer and cosmographer. He must be credited, in M. Vignaud's opinion, not only with the discovery of the largest extent of American coast-line achieved by any one voyager, but with the first correct appreciation of the meaning of the new discoveries, and the importance of seeking a passage to the east by the southern extremity of South America. These are large claims to rest on the evidence of Vespucci's own testimony only, more especially as there is nothing to indicate that he occupied any dominating position in the voyages in which he took part. Any views which he held were as likely to be imbibed from (or at least shared with) his associates, as to have originated with himself; the accident that it is *his* accounts of the voyages which have survived being the principal reason why those views should be associated with his name. The question, however, is one which can never be definitely settled.

The Royal Society Celebration.—The two hundred and fiftieth anniversary of the foundation of the Royal Society was celebrated during the week beginning July 15. A large number of delegates representing learned societies and institutions at home and abroad took part, and the proceedings included receptions of the delegates, a commemorative service in Westminster Abbey, a banquet in the Guildhall, a Royal garden party at Windsor, and other functions. The R.G.S. was represented by Major Leonard Darwin.

The Twelfth International Geological Congress.—A first circular, describing the arrangements for this Congress, which will meet at Toronto in 1913, has been issued. The meeting is fixed for the eight days beginning on or about August 21, and a list of topics for discussion, seven in all, is put forward, of which those most closely concerning geography are No. 1, "The Coal Resources of the World," and No. 6, "To what extent was the Ice Age broken by interglacial periods?" A series of twelve excursions—varying from one to twelve days, but mostly occupying about three—has been arranged to take place before the meeting, and ten after. The latter include four trans-continental excursions by the different trunk railways, and others of less extent, as well as one to Yukon and Northern British Columbia, for which twenty-three days will be necessary. There will also be short excursions in the neighbourhood of Toronto during the meetings. Inquiries are to be addressed to the Secretary, International Geological Congress, Victoria Memorial Museum, Ottawa.

OBITUARY.

Alexander Knox.

By the death of Alexander Knox many sections of the War Office, and, in particular, the Geographical Section of the General Staff, have suffered a loss which it will be hard to make good. He had been, as is well known to those who have had dealings with the Geographical Section, for many years the map curator. Thanks to his efforts, the War Office collection of modern topographical maps is now of

unrivalled completeness. He had a great fund of information on the subject of maps and map-collections, and he always put this information freely at the disposal of inquirers. The numerous officers who, during the course of any working day, were to be found in his office looking up the most reliable maps of the scene of the latest war or disturbance always found the readiest and most courteous attention.

He was the author of several technical books, and of these the most valuable, as it is also the most recent, is his 'Account of the Climate of Africa,' a work which is a standard authority on the subject. For those who are in any way concerned with the despatch of geographical expeditions to that continent this book is quite indispensable. The Royal Geographical Society contributed liberally to the cost of its publication, and it is a pleasure to the writer to feel that the Society in so doing expressed unmistakably the high opinion held by geographers of the value of Mr. Knox's labours. C. F. C.

CORRESPONDENCE.

Recent Antarctic Expeditions.

Royal Scottish Geographical Society, Edinburgh, July 6, 1912.

On p. 578 of the *Journal* for June, Sir Clements Markham makes the statement to the effect that the recent Belgian, German, Swedish, Scottish, and French Antarctic expeditions were of no use as regards Antarctic discovery. In the interest of scientific accuracy this misstatement should be corrected, and without any desire to follow Sir Clements Markham in instituting comparisons between expeditions, all of which did good work, may we remind him that the Scottish expedition, so far from making no discoveries in Antarctic geography, brought the coast-line in the Weddell sea from its supposed position in 82° S. to an actual one in 74° S., and by the discovery of Coats Land made the greatest change in the Antarctic map that has been effected since Ross's discovery of Victoria Land. The addition of half a million square miles to Antarctica can scarcely be dismissed in such an airy way.

Furthermore, none of these expeditions above mentioned made any attempt at "mere rushing to the pole with that as an object." The aim of one and all was that scientific exploration which, in the opinion of all competent authorities, is most required in Antarctic regions. The many misleading statements relating to other expeditions which this article contains, we leave to the explorers connected with these expeditions to correct. Again, Sir Clements Markham has overlooked the fact that since 1883, if not earlier, Sir John Murray strenuously advocated the renewal of Antarctic exploration, which is at least eight years before the date when Sir Clements claims to have originated the idea. The furtherance of geographical knowledge demands that such statements should not be allowed to stand unchallenged.

R. N. Rudmose Brown.
J. H. Harvey Pirie.

Unstead and Taylor's 'Commercial Geography.'

We regret again to invade your space, but the reviewer's reply to our protest tends to confuse the issues; we would therefore ask to be allowed a brief, and final, reply.

1. The facts adduced merely justify our caution to students that the *winter* rainfall of Egypt (1·85 inches per month at Alexandria) is not of service to the cotton crop.

2. Even when all the negative evidence collected by the reviewer is accepted, there remains a list of ten districts in the Balkan peninsula in which coal deposits exist.

3. The reviewer originally charged us with being "absolutely misleading" in mentioning lemons among the products of Florida; this charge cannot now be maintained, even though he may differ from us in regard to their relative importance.

4. We cannot accept the reviewer's suggestion that the only natural bases of the cotton industry in New England are climate and coal. The relative humidity of the atmosphere of the northern region does not appreciably differ from that of the southern region, and the coal has to be brought from a very considerable distance; hence we still deem it correct to draw the special attention of the pupils to the water-power of New England as its chief natural resource.

J. F. UNSTEAD.
E. G. R. TAYLOR.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1911-1912.

Sixteenth Meeting, June 24, 1912. The Right Hon. Earl CURZON OF KEDLESTON, G.C.S.I., G.C.I.E., etc, President, in the Chair.

ELECTIONS.—*C. J. Bowen Cooke; Chas. Davenport, M.A.; Thos. Evan Davies; Edwin G. Foot; Bernard Guy Harrison; Frank R. Hartley; John Leader MacCarthy; Alan Grant Ogilvie, B.A.; R. C. H. Sinclair; Edward James Wayland.*

The paper read was:—

"A Year's Exploration in the Sonora Desert, Mexico." By Dr. Carl Lumholtz.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
Jber. = Jahresbericht.
k.k = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. = (Riv.) = Review, Revue, Rivista
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo, quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Adriatic.

R. Comitato Talassografico Italiano. Memoria III. Risultati fisico-chimici delle prime cinque crociere Adriatiche (Agosto 1909—Febbraio 1911). Venice, 1911. Size 10½ × 7½, pp. 84. *Sketch-map and Diagrams.*

Alps—Avalanches. *Petermanns M.* **58** (1912): I., 126–128. **Frech**

Ueber die Lawinen der Alpen. Von Prof. Dr. Fr. Frech.

Alps—Geology. *C.R.A. Sc. Paris* **154** (1912): 853–856. **Kilian and Jacob.**

Sur le non-parallélisme des zones isopiques et des accidents tectoniques dans les Alpes franco-italiennes et le Valais. Par W. Kilian et Ch. Jacob.

Alps—Geology. **Sacco.**

Il Gruppo dell' Argentera. Studio geologico di Federico Sacco. (Estr. dalle Memorie della Reale Accademia delle Scienze di Torino, serie ii. tom. lxi., appr. nell' adunanza del 18 Dicembre 1910.) Turin, 1911. Size 12½ × 9½, pp. 457–516. *Maps and Sections.*

Alps—Geology. *Smithsonian Misc. Coll.* **56** (1912): No. 31, pp. 14. **Willis.**

Report on an investigation of the geological structure of the Alps. By Bailey Willis. *Sections.*

Alps—"Karren." **Heim and Arbenz.**

Geol. Charakterbilder (Stille) (1912): Heft. I., 7 Plates.

Karrenbildungen in den Schweizeralpen. Von Arnold Heim und Paul Arbenz. *Illustrations.*

Alps—Mont Blanc—First ascent. *Alpine J.* **26** (1912): 36–52. **Montagnier.**

Dr. Paccard's lost narrative: A note. By Henry F. Montagnier. *Facsimiles.*

The writer's researches, which have brought to light a unique copy of the prospectus of Dr. Paccard's promised book, tend to show that the latter was never printed.

Alps—Morphology. *C.R.A. Sc. Paris* **154** (1912): 802–806. **Kilian and Jacob.**

Sur la tectonique des montagnes situées entre le Mont-Blanc et le petit Saint-Bernard. Par W. Kilian et Ch. Jacob. *Sections.*

Austria—Bohemia. *Abh. K.K.G. Ges. Wien* **9** (1912): No. 3, pp. 210. **Friedrich.**

Die historische Geographie Böhmens bis zum Beginne der deutschen Kolonisation. Von Dr. Wilhelm Friedrich. *Maps and Plans.*

Austria—Bohemia. **Müller.**

Internationale Rev. Hydrobiologie, Hydrog. Suppl. **3** (1912): [No. 5], pp. 4.

Die Entstehung der Seebecken im Gebiete des oberen Polenztales in Nordböhmen. Von Dr. Bruno Müller.

Austria—Lunz Lakes. **Götzinger.**

Internationale Rev. Hydrobiologie, Hydrog. Suppl. **1** (1912): [No. 3]; **2** (1912): [No. 1], pp. 156.

Die Lunzer Seen. Bericht über die Ergebnisse der naturwissenschaftlichen Aufnahmen im Arbeitsgebiete der Biologischen Station Lunz. Von Dr. Gustav Götzinger. *Maps, Illustrations, and Sections.*

A preliminary communication on the same subject was noticed in vol. **39**, p. 154.

Austria—Morphology. **Hilber.**

Taltreppe. Eine geologisch-geographische Darstellung. Von V. Hilber. Graz, 1912. Size 10½ × 6½, pp. 50. *Map and Illustrations.*

Austria—Tyrol. **Stoddard.**

Tramps through Tyrol: life, sport, and legend. By F. W. Stoddard. London: Mills & Boon, [1912]. Size 9 × 5½, pp. x. and 300. *Map and Illustrations. Price 7s. 6d. net. Presented by the Publishers.*

Europe. **Chamberlain.**

Europe: a supplementary geography. By J. F. Chamberlain and A. H. Chamberlain. ('The Continents and their People.') New York (London: Macmillan & Co.), 1912. Size 7½ × 5, pp. viii. and 258. *Maps and Illustrations. Price 3s. Presented by the Publishers.*

France—Pyrenees. **Jackson.**

Rambles in the Pyrenees and the adjacent districts: Gascony, Pays de Foix, and Roussillon. By F. Hamilton Jackson. London: J. Murray, 1912. Size 9½ × 6½, pp. xii. and 420. *Map, Plans, and Illustrations. Price* 21*s. net. Presented by the Publisher.*

Germany—Black Forest. **Muller.**

Vegetationsbilder (ed. Karsten and Schenck) **9** (1911): Plates 31–42.

Vegetationsbilder aus dem Schwarzwald. Von Dr. Karl Muller.

Germany—Historical. **Blume.**

Die germanischen Stämme und die Kulturen zwischen Oder und Passarge zur römischen Kaiserzeit. Von Erich Blume. I. Teil: Text. (Mannus-Bibliothek, herausgegeben von Prof. Dr. Gustaf Kossinna; No. 8.) Würzburg: C. Kalitzsch, 1912. Size 10½ × 7½, pp. vi. and 214. *Map and Illustrations. Price* 8*m. Presented by the Publisher.*

Germany—Taunus. *Forschungen deuts. Landes- u. Volksk.* **19** (1912): 441–464. **Schmidt.**

Niederschlagskarten des Taunus. Von Albert Schmidt. *Sketch-maps and Diagrams.*

Germany—Towns. **Penck.**

Die Lage der deutschen Grossstädte. Von Dr. Albrecht Penck. (Städtebauliche Vorträge aus dem Seminar für Städtebau an der K. Technischen Hochschule zu Berlin; herausgegeben von . . . J. Brix und F. Genzmer; Band v., Heft 5.) Berlin: W. Ernst und Sohn, 1912. Size 10½ × 7½, pp. 38. *Price* 2*m. Presented by the Publishers.*

Greece—Delos. **Cayeux.**

Exploration archéologique de Délos, faite par l'École Française d'Athènes sous les auspices du Ministère de l'Instruction Publique . . . et publiée sous la direction de Théophile Homolle et Maurice Holleaux. (Fascicule iv., 1.) Description physique de l'île de Délos (1re partie). Par Lucien Cayeux. Paris: Fontemoing et Cie., 1911. Size 14 × 11, pp. 216. *Maps and Illustrations. Presented by the École Française d'Athènes.*

Holland—Anthropology. *Ts. K. Ned. Aardr. Genoots.* **29** (1912): 14–24. **Sasse.**

Onzekerheden en vraagpunten betreffende de antropologie van Nederland. Door Dr. J. Sasse.

Hungary—Germans. *Deutsche Erde* (1911): 43–46, 68–76, 125–129, 148–161. **Pfaundler.**

Das deutsche Sprachgebiet in Südungarn. Von Dr. Richard v. Pfaundler. *Maps.*

Italy—Lombardy. *Riv. G. Italiana* **18** (1911): 392–411, 475–486. **Ricci.**

Ricerche sul lago di Capo di Lago (Lago Moro) in Valcamonica. Di Leonardo Ricci. *Sketch-maps and Illustration.*

Italy—Piedmont—Meteorology. *Riv. G. Italiana* **18** (1911): 433–458. **Anfossi.**

La pioggia nell' alta valle del Gorzente. Contributo alla climatologia dell' Appennino Ligure, di Giovanni Anfossi. *Sketch-maps and Diagrams.*

Italy—Romagna. *B.S.G. Italiana*, V. **1** (1912): 111–142. **Azzi.**

I fenomeni della erosione nelle argille azzurre del pliocene nel bacino del Santerno (Romagna). Del dott. Girolami Azzi. *Sketch-map and Profiles.*

Italy—Rome—Climate. **Eredia.**

Il clima di Roma. Esame delle osservazioni meteorologiche eseguite dal 1782 al 1910. (Studio del Dottor Filippo Eredia.) (Estratto dagli *Annali dell' Ufficio Centrale di Meteorologia e Geodinamica*, vol. **32**, 1910.) Rome, 1911. Size 13½ × 9½, pp. 100. *Diagrams.*

Italy—Venetia—Hydrology. **Marchi.**

R. Magistrato alle Acque; Ufficio Idrografico, Pubblicazione N. 22. Sull' idrografia carsica nell' Altipiano dei Sette Comuni. (Del prof. Luigi de Marchi.) Venice, 1911. Size 10½ × 7, pp. viii. and 48. *Map and Illustrations.*

Norway. *La G., B.S.G. Paris* **24** (1911): 355–378. **Rabot.**

Récents travaux géographiques et géologiques dans la Norvège septentrionale. Par Charles Rabot. *Sketch-maps and Illustrations.*

A useful summary of recent progress.

Norway. *Ann. G.* **20** (1911): 396–410. **Vallaux.**

Le pays de Voss et du Hardanger Fjord. Par Camille Vallaux. *Sketch-map and Illustrations.*

Norway—Svartisen—Geology. **Marstrander.**

Svartisen: dens geologi. Af Rolf Marstrander. (Reprinted from *Norges Geologiska Undersökning, Aarbok*, 1911, iv.) [Christiania, 1911.] Size 9 × 6, pp. 32. *Map, Illustrations, and Sections.*

Poland. *Petermanns M.* **57** (1911): II. 363-364; **58** (1912) I.: 61-62. **Kuchinka.**

Das Königreich Polen als strategisches Terrain. Von Hauptmann G. Kuchinka. *Map.*

Russia—Murman coast. **Breitfuss.**

L. L. Breitfuss. Wissenschaftlich-praktische Murman-Expedition: Bericht über die Tätigkeit pro 1905. St. Petersburg, 1912. Size 12 × 8½, pp. vi. and 208. *Maps and Illustrations.* [In Russian.]

Switzerland. *La G., B.S.G. Paris* **24** (1911): 382-389. **Delpech.**

La troisième excursion en Suisse du Laboratoire de géographie physique de l'Université de Paris. Sous la direction de MM. Ch. Vélain, Jean Brunhes et Paul Girardin. Par Jean Delpech.

United Kingdom—Archæology. **Warren.**

On the Correlation of the Prehistoric "Floor" at Hullbridge, with similar beds elsewhere. By S. Hazzledine Warren. (Reprinted from the *Essex Naturalist*, vol. 16, 1911.) [Stratford, 1911.] Size 8½ × 5½, pp. 265-282.

United Kingdom—Cambridge—Ecology. **Adamson.**

J. Linnean S. (Botany) **40** (1912): 339-384.

An ecological study of a Cambridgeshire Woodland. By R. S. Adamson. *Illustrations.*

United Kingdom—Dumfries. **Hewison.**

Cambridge County Geographies (Scotland, edited by W. Murison). Dumfriesshire. By Dr. James King Hewison. Cambridge: University Press, 1912. Size 7½ × 5, pp. x. and 176. *Maps, Illustrations, and Diagrams. Price* 1*s.* 6*d. Presented by the Publishers.*

United Kingdom—Historical. **Hardie.**

The Tobermory argosy: a problem of the Spanish Armada. By R. P. Hardie. Edinburgh: Oliver & Boyd, 1912. Size 9 × 6, pp. vi. and 68. *Price* 1*s. net. Presented by the Publishers.*

United Kingdom—Ireland—Sligo. **Macalister and others.**

P.R. Irish A. **29**, Sect. C. (1912): 311-347.

Report on the exploration of bronze-age cairns on Carrowkeel Mountain, Co. Sligo. By R. A. S. Macalister, E. C. R. Armstrong, and R. Ll. Praeger. *Plans and Illustrations.*

United Kingdom—Kennet and Avon Canal. **Finch.**

To the West of England by canal. By Robert J. Finch. (The "Educational Journey" Series: General Editor, Horace Piggott.) London: J. M. Dent & Sons, 1912. Size 7 × 4½, pp. 64. *Sketch-maps, Profile, and Illustrations. Price* 9*d. net. Presented by the Publishers.*

United Kingdom—Oxford. **[Blowfield and] Salter.**

Survey of Oxford in 1772. Edited by Rev. H. Salter. Oxford: H. Frowde, 1912. Size 9 × 6, pp. 82. *Plans. Price* 2*s. net. Presented by the Publisher.*

United Kingdom—Oxfordshire. **Günther.**

The Oxford country: its attractions and associations described by several authors, collected and arranged by R. T. Günther. London: J. Murray, 1912. Size 8 × 5, pp. xvi. and 320. *Sketch-maps and Illustrations. Price* 7*s.* 6*d. net. Presented by the Publisher.*

United Kingdom—Perthshire. **Macnair.**

Cambridge County Geographies (Scotland, edited by W. Murison). Perthshire. By Peter Macnair. Cambridge: University Press, 1912. Size 7½ × 5, pp. xii. and 180. *Maps, Illustrations, and Diagrams. Price* 1*s.* 6*d. Presented by the Publishers.*

United Kingdom—Renfrew. **Mort.**

Cambridge County Geographies (Scotland, edited by W. Murison). Renfrewshire. By Frederick Mort. Cambridge: University Press, 1912. Size 7½ × 5,

pp. x. and 178. *Maps, Illustrations, and Diagrams. Price* 1*s.* 6*d. Presented by the Publishers.*

United Kingdom—Scotland. *Scottish G. Mag.* **28** (1912): 76–89. **Wedderburn.**

Investigation of temperature distribution in Loch Earn. By E. M. Wedderburn. *Plan, Illustrations, and Sections.*

United Kingdom—Wiltshire. **Chubb.**

A descriptive catalogue of the printed maps of Wiltshire from 1576 to the publication of the 25-inch Ordnance Survey, 1885. By T. Chubb. (Reprinted from the *Wiltshire Archæological and Natural History Magazine*, vol. **37**, p. 211.) [Devizes, 1911.] Size 8½ × 5½, pp. 116.

See review in vol. **39**, p. 471.

ASIA.

Asia—Ancient trade. **Herrmann.**

Alte Verkehrsbeziehungen zwischen China und Vorderasien. Von Dr. Albert Herrmann. (Separat-Abdruck aus Weltverkehr und Weltwirtschaft, März, 1912.) [Cöthen, 1912.] Size 12½ × 9½, pp. 557–562. *Sketch-map.*

Asia—Historical. **Dahlmann.**

Die Thomas-Legende und die ältesten historischen Beziehungen des Christentums zum fernen Osten im Lichte der indischen Altertumskunde. Von Joseph Dahlmann, S.J. Freiburg i. Br., Herder, 1912. Size 9½ × 6, pp. iv. and 174. *Price* 3*m. Presented by the Publisher.*

Asia Minor—Historical. **Sölch.**

Modrene, Modroi und Gallus. (Nebst Bemerkungen über die Nordgrenze von Phrygia Epiktetos und die Lage der bithynischen Bistümer.) Von Joh. Sölch. (Sonderdruck aus 'Klio, Beiträge zur alten Geschichte,' Bd. XI. Heft 4, 1911.) Leipzig, 1911. Size 11 × 7½, pp. 393–414.

Asia Minor—Historical. **Sölch.**

Ueber die Lage von Kaisareia in Bithynien. Von Joh. Sölch. (Sonderdruck aus 'Klio, Beiträge zur alten Geschichte,' Bd. XI., Heft 3, 1911.) Leipzig, 1911. Size 11 × 7½, pp. 325–334.

Ceylon—Pearl Fisheries. *National G. Mag.* **23** (1912): 173–194. **Smith.**

The pearl fisheries of Ceylon. By Hugh M. Smith. *Illustrations.*

China. **Zi-ka-wei Observatory.**

Observatoire de Zi-ka-wei. Calendrier-Annuaire pour les années 1903–1910 (8 vols.). Shanghai, 1902–09. Size 6 × 4. *Sketch-maps and Diagrams. Presented by the Superintendent, Zi-ka-wei Observatory.*

China—Chusan. *T'oung Pao* **12** (1911): 728–735. **Simon.**

Ein alter Plan der beiden Hauptstädte des ehemaligen Königreiches Chusan. Von Dr. Edmund Simon.

China—Legendre Expedition. *La G., B.S.G. Paris* **24** (1911): 345–354. **Legendre.**

Récente exploration du Dr. Legendre. Par A. Legendre. *Map.*

See note in the March number, p. 280.

China—Minerals. **Wang.**

Bibliography of the mineral wealth and geology of China. By Chung Yu Wang. London: C. Griffin & Co., 1912. Size 8 × 5, pp. vi. and 64. *Price* 3*s. net. Presented by the Publishers.*

Though making no claim to be exhaustive, this bibliography will be of use to those interested in the development of Chinese mineral wealth. The most important minerals have headings to themselves, the rest being arranged under Minerals in General, General Geology, Petrology, etc.

China—Population. *T'oung Pao* **13** (1912): 117–125. **Rockhill.**

The 1910 census of the population of China. By W. W. Rockhill.

China—Yunnan—Railway. *B.S.G. Italiana* V. **1** (1912): 383–408, 505–531. **Mazzolani.**

In ferrovia da Junnansen a Lao-cai. Del dott. Domenico Mazzolani. *Illustrations.*

Chinese Empire. **Clementi.**

Summary of geographical observations taken during a journey from Kashgar to Kowloon (1907–08). By Cecil Clementi. Hongkong, 1911. Size 13 × 8, pp. vi. and 112. *Presented by the Author.*

Chinese Empire—Meteorology. **Coales.**

Observations made during a journey through the provinces of Ssuch'uan, Kansu and Chinese Turkestan during the seven months from June to December, 1910. By Oliver Robert Coales. [Typewritten sheets.] Size 13 × 8, pp. 34.

This journey was the subject of a note (with map) in the February number. p. 155.

Chinese Turkestan—Climate. **Strokovski.**

B.A. Imp. Sc. St. Pétersbourg (1912): 341–360.

Sur le climat de Urumci. Par V. A. Strokovskij. *Sketch-map and Diagrams.* [In Russian.]

Malay Archipelago—Java—Meteorology. **Bemmelen.**

Koninklijk Magnetisch en Meteorologisch Observatorium te Batavia. Verhandelingen No. I. Die Windverhältnisse in den oberen Luftschichten nach Ballonvisierungen in Batavia. Von Dr. W. van Bemmelen. Batavia: Javasche Boekhandel en Drukkerij, 1911. Size 9½ × 7½, pp. 78. *Sketch-maps.*

Persia—Historical. *J.R. Asiatic S.* (1912): 1–30. **Le Strange.**

Description of the province of Fars, in Persia, at the beginning of the twelfth century A.D. Translated from the Manuscript of Ibn-al-Balkhi in the British Museum by G. Le Strange.

Russia—Siberia—Geology. **Obrucheff.**

Geological sketch of the auriferous deposits of Siberia. (Part I.) Sayansk region. (Part II.) Central Siberia. By V. A. Obrucheff. St. Petersburg, 1911. Size 10 × 7, pp. 70. *Maps.* [In Russian.]

Russia—Waterways. *Deutsche Rundschau G.* **33** (1911): 433–439. **Hennig.**

Russische Grossschiffahrtswege. Von Dr. R. Hennig. *Map.*

Turkey—Palestine. **Macalister.**

A history of civilization in Palestine. By R. A. S. Macalister. Cambridge: University Press, 1912. Size 7 × 5, pp. viii. and 140. *Map and Illustrations. Price 1s. net. Presented by the Publishers.*

AFRICA.

Africa—Railway. *Rev. Française* **37** (1912): 257–278. **Berthelot.**

Un Transafricain: d'Alger au Cap. Par A. Berthelot. *Sketch-map.*

See note in vol. **39**, p. 283.

Africa—Railways. *B.S.G. Comm. Paris* **33** (1912): 161–192. **Roume.**

Les Chemins de fer en Afrique et le transafricain. Par V. E. Roume. *Sketch-maps.*

Cf. note in the March number, p. 283.

Belgian Congo. *B.S.G. Italiana*, V., **1** (1912): 293–299. **Stoppani.**

Riassunto del rapporto dell' ing. Percy Stoppani sull' Uellé ed Ituri (alto Congo).

Belgian Congo. *Mouvement G.* **29** (1912): 236–239. ———

La nouvelle organisation territoriale de la colonie. *Map.*

See note in the May number, 1912, p. 491.

Belgian Congo—Communications. **Moulaert.**

Rev. Congolaise **1** (1910): 487–500; **2** (1911): 1–25.

Voies de communication et de transport au Congo Belge. Par le Commissaire-général Moulaert. *Maps.*

Belgian Congo—Communications. *B.S. Belge d'Études Col.* **19** (1912): 297–345. ———

Les communications par chemin de fer et par voie fluviale au Congo belge.

Belgian Congo—Frontier. *Mouvement G.* **29** (1912): 253–260. **Maury.**

La description de la frontière orientale du Congo belge. Par le lieutenant Maury. *Map.*

Belgian Congo—Katanga. **Gardet.**

Georges Gardet. Histoire du Katanga. Tirlemont, 1912. Size 6½ × 5, pp. 84. *Price 5 fr. Presented by the Author.*

A brief outline of the exploration of Katanga down to about 1900. The recent economic development is but slightly touched upon.

Kamerun—Adamawa. *M.G. Ges. Hamburg* **26** (1912): 47–107. **Strümpell.**

Die Geschichte Adamauas nach mündlichen Ueberlieferungen. Von Hauptmann Kurt Strümpell. *Illustrations.*

Lagos and Gambia. *J. African S.* **11** (1912): 129–140. **Denton.**
Twenty-three years in Lagos and the Gambia. By Sir George Denton. *Illustrations.*

Mauritius—Rainfall. *Symons's Met. Mag.* **47** (1912): 5–7. **Raulin.**
Distribution of rain in Mauritius during the decade 1891–1900. By the late Prof. V. Raulin.

Morocco—Iron-ores. *Z. Kolonialpolitik* **14** (1912): 29–35. **Goldberg.**
Marokkos Eisenerze in ihrer wirtschaftlichen Beziehung zu Deutschland. Von Gottfried Goldberg.

Nigeria—Northern.
Northern Nigeria. Report for 1910–11. (Colonial Reports, Annual No. 704, 1912.) London, 1912. Size 9½ × 6, pp. 46. *Map.*

Nigeria—Survey. *J.R. Artillery* **38** (1912): 477–482. **Rowe.**
Topographical Survey in Tropical Africa. A short account of the Southern Nigeria Survey. By Captain R. H. Rowe. *Illustrations.*

North Africa—Dry-farming. *Ann. G.* **20** (1911): 411–430. **Bernard.**
"Le dry-farming" et ses applications dans l'Afrique du Nord. Par Augustin Bernard.

Réunion—Volcano. *C.R.A. Sc. Paris* **154** (1912): 169–175. **Lacroix.**
Le volcan de la Réunion. Par A. Lacroix.

Rhodesia. **Moubray.**
In South Central Africa; being an account of some of the experiences and journeys of the author during a stay of six years in that country. By J. M. Moubray. London: Constable & Co., 1912. Size 9 × 5½, pp. xvi. and 198. *Map and Illustrations. Price* 10*s.* 6*d. net. Presented by the Publishers.*

South Africa—Irrigation. *J.R.S. Arts* **60** (1912): 327–344. **Legg.**
Irrigation in South Africa. By W. A. Legg. *Sections.*

Tripoli. **McCullagh.**
Italy's war for a desert; being some experiences of a war-correspondent with the Italians in Tripoli. By Francis McCullagh. London: Herbert & Daniel, [1912]. Size 9 × 5½, pp. xxxvi. and 410. *Illustrations. Price* 10*s.* 6*d. net. Presented by the Publishers.*

Tripoli. **Todd.**
Tripoli the mysterious. By Mabel Loomis Todd. London: Grant Richards, 1911. Size 8½ × 5½, pp. xvi. and 214. *Illustrations. Price* 7*s.* 6*d. net. Presented by the Publishers.*

Tunis—Bizerta—Longitude. *C.R.A. Sc. Paris* **154** (1912): 181–184. **Bourgeois.**
Résultats des observations faites pour la détermination par la Télégraphie sans fil, de la différence de longitude entre Paris et Bizerte, obtenus par MM. Noirel et Bellot. Par M. Bourgeois. *Diagrams.*
See note in the March number, p. 283.

West Africa—Communications. **Mercier.**
Renseignements Col., Afrique française (1911): 276–285.
La voie de la Bénoué. Par Capitaine Mercier. *Sketch-maps.*

West Africa—Frontier. *Rev. G. Comm. G.S. Bordeaux* (1912): 19–40. **Peyrissac.**
La frontière Franco-Libérienne. Par Léon Peyrissac. *Sketch-maps and Illustrations.*

West Central Africa. *Z. Ges. Erdkunde Berlin* (1912): 1–7. **Mecklenburg.**
Herzog Adolf Friedrich zu Mecklenburg über seine "Inner-Afrika-Expedition 1910–11."

NORTH AMERICA.

Alaska—Glaciers. *Science* **35** (1912): 241–258. **Tarr.**
The Glaciers and Glaciation of Alaska. By Prof. Ralph S. Tarr.

Canada—Abitibi. *B.S.G. Québec* **6** (1912): 115–129. **Bellefeuille.**
Au lac Abitibi. 'Relation de la mission en 1837 par Mr. de Bellefeuille chez les sauvages du lac Abbitibbi.'
Reprint of the original narrative.

Canada—Alberta. **Department of Mines.**

Canada. Department of Mines. Geological Survey Branch. Memoir No. 27. Report of the Commission appointed to investigate Turtle Mountain, Frank, Alberta, 1911. Ottawa, 1912. Size 10 × 7, pp. 34. *Maps, Sections, and Illustrations.*

See June number, p. 613.

Canada—British Columbia—Anthropology. **Emmons.**

Univ. Pennsylvania Museum, Anthrop. Publ. **4** (1911): No. 1, pp. 120.

The Tahltan Indians. By G. F. Emmons. *Sketch-map, Plan, and Illustrations.*

Canada—Census. **Census and Statistics Office.**

Fifth Census of Canada, 1911. Special report on Area and Population. Published by the Census and Statistics Office. Ottawa, 1912. Size 10 × 6½, pp. vi. and 172.

Canada—Ontario—Archæology. **Minister of Education.**

Annual Archæological Report, 1911. Including 1808–9–10. Being part of Appendix to the Report of the Minister of Education, Ontario. Printed by order of the Legislative Assembly of Ontario. Toronto, 1911. Size 9½ × 6½, pp. 104. *Illustrations.*

Canada—Place-names. *B.S.G. Québec* **5** (1911): 410–422; **6** (1912): 31–42. **Rouillard.**

Noms Géographiques Sauvages. Etymologie et traduction. Par Eug. Rouillard. *Illustrations.*

Canada—Selkirks. **Wheeler.**

The Selkirk Mountains: a guide for mountain climbers and pilgrims. By A. O. Wheeler. Winnipeg: Stovel Co., [1912]. Size 7½ × 5, pp. xiii. and 200. *Maps and Illustrations. Price* $1.50. *Presented by the Author.*

Canada—Wheat. *B. American G.S.* **44** (1912): 10–17. **Bishop.**

Development of wheat production in Canada. By Avard L. Bishop.

United States—Irrigation. *Smithsonian Rept.* 1910 (1911): 169–198. **Newell.**

Progress in reclamation of arid lands in the Western United States. By F. H. Newell. *Sketch-map and Illustrations.*

United States—Mineral resources. *Rev. G. Ann.* **4** (1910): 309–357. **Guillotel.**

Ressources minérales des États-Unis. Le cuivre, le charbon et le fer. Par F. Guillotel. *Diagrams.*

United States—Rainfall. *Monthly Weather Rev.* **39** (1911): 1609–1615. **Reed.**

The cyclonic distribution of rainfall in the United States. By William Gardner Reed. *Charts.*

United States—Rocky mountains. **Henry.**

B. Mount Weather Observatory **4** (1911): 103–114.

Variations of temperature at summit and base stations in the central Rocky Mountain region. By Alfred J. Henry. *Diagram.*

United States—Utah. *National G. Mag.* **22** (1911): 1048–1056. **Pogue.**

The great rainbow natural bridge of Southern Utah. By Joseph E. Pogue. *Illustrations.*

United States—Vegetation. **Harper.**

The relation of climax vegetation to islands and peninsulas. By Roland M. Harper. (From the *Bulletin* of the Torrey Botanical Club, vol. 38, 1911.) N.P., 1911. Size 9 × 6, pp. 515–525.

CENTRAL AND SOUTH AMERICA.

Bolivia. *B.S.G. La Paz* **9** (1911): 19–58. **Paredes.**

Altiplanicie paceña. Por Rigoberto Paredes.

Bolivia-Brazil Boundary. **Fawcett.**

Minist. Relaciones Exteriores [*Bolivia*], *Memoria* 1910 (1910): *Anexos*, 1–57.

Informe presentado por el señor J. H. Fawcett . . . sobre el trabajo de la Comisión en el N. O. de la frontera, 1906–07. *Maps.*

Informe de la Comision de Límites, 1909 [J. H. Fawcett, Jefe Técnico de la Comisión]. *Maps.*

Bolivia—Rubber. **Ballivian and Pinilla.**

Dirección General de Estadistica y Estudios Geográficos. Monografia. Industria de la goma elastica en Bolivia. Por Manuel V. Ballivian y Casto F. Pinilla. La Paz, 1912. Size 8½ × 5½, pp. vi, 354, and lxxxiv. *Maps and Illustrations.*

Brazil—Upper Amazon. **Lange.**

In the Amazon jungle: adventures in remote parts of the Upper Amazon river, including a sojourn among cannibal Indians. By Algot Lange. New York and London: G. P. Putnam's Sons, 1912. Size 9 × 6, pp. xx. and 406. *Sketch-maps and Illustrations. Price* 10*s.* 6*d. net. Presented by the Publishers.*

Columbia—Atrato. **Vallejo.**

Por el Atrato. Por José Vallejo. Jerico, 1910. Size 8½ × 5½, pp. 62.

Guiana. **Rodway.**

Guiana: British, Dutch, and French. By James Rodway. London: T. Fisher Unwin, 1912. Size 9 × 6, pp. 318. *Map and Illustrations. Price* 10*s.* 6*d. net. Presented by the Publisher.*

South America—Archæology. **Joyce.**

South American archæology: an introduction to the archæology of the South American continent, with special reference to the early history of Peru. By Thomas A. Joyce. London: Macmillan & Co., 1912. Size 9 × 6, pp. xvi. and 292. *Maps and Illustrations. Price* 12*s.* 6*d. net. Presented by the Publishers.*

AUSTRALASIA AND PACIFIC ISLANDS.

New Guinea, Dutch. **Wollaston.**

Pygmies and Papuans: the Stone age to-day in Dutch New Guinea. By A. F. R. Wollaston. London: Smith, Elder & Co., 1912. Size 9½ × 6, pp. xxiv. and 352. *Maps and Illustrations. Price* 15*s. net. Presented by the Publishers.*

Pacific—Ethnology. **Smith.**

Hawaiki, the original home of the Maori; with a sketch of Polynesian history. By S. Percy Smith. 3rd edit. London, etc.: Whitcombe & Tombs, 1910. Size 7½ × 5, pp. 302. *Sketch-map and Illustrations. Price* 5*s.*

POLAR REGIONS.

Antarctic—Scottish Expedition. **Bruce.**

Scottish National Antarctic Expedition. Report on the scientific results of the voyage of S.Y. *Scotia* during the years 1902, 1903, and 1904, under the leadership of Dr. William S. Bruce. Vol. 3, Botany, parts 1–11. Edinburgh: Scottish Oceanographical Laboratory, 1912. Size 12½ × 9½, pp. x. and 154. *Sketch-map and Illustrations. Price* 23*s.* 6*d. Presented by Dr. W. S. Bruce.*

MATHEMATICAL GEOGRAPHY.

Cartography—Projections. *R. Engineers J.* **15** (1912): 91–106. **Hinks.**

Map Projections in actual use. By Arthur R. Hinks. *Diagrams.*

Determination of Position. *Mouvement G.* **28** (1911): 644–647. **Dehalu.**

Le rôle de la télégraphie sans fil dans la cartographie coloniale. Par M. Dehalu.

Geodesy. *La G., B.S.G. Paris* **24** (1911): 379–381. **Harkányi.**

Sur la longueur be l'arc minimum du méridien d'un ellipsoïde de révolution à volume constant. Par Baron B. Harkányi.

Geodesy—Congress. **International Geodetic Association.**

Comptes rendus des séances de la Seizième Conférence Générale de l'Association Géodésique Internationale, réunie à Londres et à Cambridge du 21 au 29 Septembre 1909. Part iii. Berlin: G. Reimer, 1911. Size 11½ × 9, pp. viii. and 288. *Maps.*

Surveying. **Kennedy.**

Surveying with the tacheometer; a practical manual for the use of civil and military engineers and surveyors. By Neil Kennedy. 3rd edit. London: Crosby Lockwood & Son, 1912. Size 8½ × 5½, pp. viii. and 104. *Diagrams. Price* 10*s.* 6*d. net. Presented by the Publishers.*

A useful book for its purpose; but hardly concerned with geographical surveying.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Geological History—Atlantis. *C.R.A. Sc. Paris* **153** (1911): 1035–1037. **Germain.**

Sur l'Atlantide. Par Louis Germain.

Bases a belief in the recent existence of Atlantis on evidence from fossils.

Geology—Loess. **Obrucheff.**

On the question of the origin of loess. (With a defence of the eolian hypothesis.) By V. A. Obrucheff. Tomsk, 1191. Size 10½ × 7, pp. 38. *Sketch-map and Sections.* [In Russian.]

Geomorphology. *Ann. G.* **20** (1911): 385–395. **Girardin.**

Topologie et topographie; à propos de l'ouvrage du général Berthaut. Par Paul Girardin.

Geomorphology—Coast-lines. **Johnson.**

Beach-cusps. By Douglas Wilson Johnson. Reprinted from the *Bulletin* of the Geological Society of America, vol. **21**, 1910.) [Rochester, 1910.] Size 10 × 6½, pp. 599–624. *Illustrations and Diagrams.*

Geomorphology—Erosion. *Rev. G. Ann.* **4** (1910): 359–421. **Vélain.**

L'Érosion éolienne et ses effets dans les régions désertiques. Par Ch. Vélain. *Illustrations and Sections.*

Geophysics. *B.A. Imp. Sc. St. Petersburg* (1912): 141–162. **Vernadski.**

Sur le régime des gaz dans l'écorce terrestre. Par V. I. Vernadskij. [In Russian.]

Geophysics—Isostasy. *J. Geology* **19** (1911): 603–626. **Lewis.**

The theory of Isostasy. By Harmon Lewis.

Geophysics—Isostasy. *Smithsonian Rept.* 1910 (1911): 391–406. **Willis.**

What is terra firma? A review of current research in isostasy. By Bailey Willis. *Illustrations and Diagrams.*

Hydrology. **Hydrographic Bureau (Sweden).**

Instruktion för iakttagelser öfver vattenstånd, is, flottning och vattentemperatur m. m. samt insamling af vattenprof. Utgifven af Hydrografiska Byrån, Stockholm, 1911. Size 8½ × 5½, pp. 24. *Section and Diagrams.*

Meteorology—Atmospheric Electricity. **Kidson.**

Terestrial Magnetism **16** (1911): 237–242.

Atmospheric electricity observations on the second cruise of the *Carnegie* from New York to Columbo. By Edward Kidson.

Meteorology—Clouds. **Quervain.**

Neujahrsblatt Naturforsch. Ges. Zürich No. 114 (1912): pp. 10.

Aus der Wolkenwelt. Von Alfred de Quervain. *Illustrations.*

Meteorology—Code. **Hellmann and Hildebrandsson**

Veröffentlichungen des K. Preussischen Meteorologischen Instituts . . . No. 242. Internationaler Meteorologischer Kodex. Im Auftrage des Internationalen Meteorologischen Komitees bearbeitet von G. Hellmann und H. H. Hildebrandsson. 2. Auflage. Berlin, 1911. Size 11 × 7½, pp. x and 104.

A codification of the results of International Congresses, with elucidations.

Meteorology—Temperature. **Humphreys.**

B. Mount Weather Observatory **4** (1911): 136–142.

The height and temperature of the isothermal region at different latitudes and under different conditions. By W. J. Humphreys.

Oceanography. **Fowler.**

Science of the sea: an elementary handbook of practical oceanography for travellers, sailors, and yachtsmen. Prepared by the *Challenger* Society for the Promotion of the Study of Oceanography. Edited by Dr. G. Herbert Fowler. London: J. Murray, 1912. Size 8 × 5, pp. xviii. and 452. *Sketch-maps and Illustrations. Price* 6*s. net. Presented by the Publisher.*

Oceanography. **Murray and Hjort.**

The depths of the ocean: a general account of the modern science of oceanography, based largely on the scientific researches of the Norwegian steamer *Michael Sars* in the North Atlantic. By Sir John Murray and Dr. Johan Hjort. London: Macmillan & Co., 1912. Size 9½ × 6½, pp. xx. and 822. *Maps, Illustrations, Sections, and Diagrams. Price* 28*s. net. Presented by the Publishers.*

Oceanography—Apparatus. *B.I. Océanog. Monaco*, No. 222 (1912): pp. 12. **Francotte.**

Appareil pour la préparation et le triage du plankton. Par Ch. Francotte. *Diagrams.*

Oceanography—Sea-water. **Palitzsch.**
Conseil Perm. Explor. de la mer, Publications de circonstance, No. 60 (1911): pp. 28.
Ueber die Messung der Wasserstoffionenkonzentration des Meerwassers. Von Sven Palitzsch.

Regional Geography. *Oversight K. Danske Vid.-S. Forhandl.* (1911): 269–317. **Vahl.**
Zones et biochores géographiques. Par Martin Vahl.

Seismology. *B.A. Imp. Sc. St. Petersbourg* (1912): 219–236. **Galitzin.**
Ueber die Dispersion und Dämpfung der seismischen Oberflächenwellen. Von B. Galitzin.

Terrestrial Magnetism. *Petermanns M.* **58** (1912): I. 8–12. **Nansen.**
Die magnetische Abweichung im Anfang des 16. Jahrhunderts. Von Dr. F. Nansen. *Sketch-maps.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Agriculture—Rice culture. *Petermanns M.* **58** (1912) I.: 15–16. **Bachmann.**
Die geographische Verbreitung des Reisbaues und seine Intensität in den Monsunländern. Von Dr. C. Bachmann. *Maps.*

Anthropogeography. **Newbigin.**
Man and his conquest of Nature. By Marion I. Newbigin. London: A. & C. Black, 1912. Size 7 × 4½, pp. viii. and 184. *Sketch-map and Illustrations. Price 2s. net. Presented by the Publishers.*

Commercial. **Macfarlane.**
Commerce of the World, 1910. An increase of 50 per cent. over 1900. Imports and exports of leading nations. By John J. Macfarlane. (Reprinted from *Commercial America*, October, 1911.) Philadelphia, 1911. Size 9 × 6, pp. 14. *Diagrams.*

Economic—Climate and Agriculture. *J.G.* **10** (1912): 195–199. **Miller.**
Local climatic peculiarities in their relation to intensive agriculture. By Eric Rexford Miller.

Economic Geography. **Kan.**
Handleiding bij de beoefening der economische aardrijkskunde, of vergelijking der landen als staten op aardrijkskundigen grondslag. Door Dr. C. M. Kan. 2 vols. (in 1). Haarlem: H. D. Tjunk Willink en Zoon, 1912. Size 10 × 6½, pp. (vol. 1) xviii. and 458; (vol. 2) xiv. and 378. *Maps and Diagrams. Presented by the Author.*

Ethnology—Fishing. *B.I. Océanog. Monaco*, No. 221 (1912): pp. 26. **Legendre.**
La pêche chez les peuples primitifs. Par R. Legendre. *Illustrations.*

Historical—Eastern voyages. *B.S.G. Marseille* **34** (1910): 165–196. **Gaffarel.**
Premiers voyages des Français dans l'Extrême-Orient. Par Paul Gaffarel.

Historical—Portuguese Worthies. **Figueiredo.**
Arte Portugueza Primitiva: I. O pintor Nuno Gonçalves, 1450. Por José de Figueiredo. (Lisbon, 1910.) Size 11 × 9, pp. 158. *Facsimile Illustrations. Presented by Sir Clements Markham.*

Contains (among others) an excellent reproduction of the portrait of Prince Henry the Navigator, by Gonçalves, introduced into one of the panels of his paintings for the chapel of S. Vicente, at Lisbon. The series, which includes other notabilities of the time, has only lately been rescued from neglect and from the ill-effects of former renovations.

Historical—Thule. *Ric. G. Italiana* **18** (1911): 459–474. **Parco.**
"L'ultima Thule" nell' intuizione e nella divinazione di F. Petrarca. Di Francesio Lo Parco.

History of Cartography. *Ts. K. Ned. Aardr. Genoots.* **29** (1912): 1–9. **Wieder.**
Onze kennis van de XVI^de^ eeuwsche cartographie. Door Dr. F. C. Wieder.

Mountain sickness. *Canadian Alpine J.* **3** (1911): 84–112. **Longstaff.**
Mountain sickness and its probable causes. By T. G. Longstaff.

Tropical diseases. ———
Tropical Diseases Research Fund. Report of the Advisory Committee for the Tropical Diseases Research Fund for the year 1911. London: P. S. King & Son, 1912. Size 13 × 8½, pp. iv. and 218. *Illustrations and Diagrams.*

BIOGRAPHY.

Blancard. *B.S.G. Marseille* **34** (1910): 72–88, 205–225. ——

Les voyages de Pierre Blancard. Navigateur marseillais, importateur du Chrysanthème (1741–1826).

Claparède. *Le Globe, B.S.G. Genève* **51** (1912): 51–65. **Gautier.**

Arthur de Claparède. Par Raoul Gautier. *Portrait.*

Flinders. *Victoria G.J.* **28** (1910–11): 12–30. **McCrae.**

Historical Sketch of the life of the late Captain Flinders, with an introduction by George Gordon McCrae.

A hitherto unpublished memoir, dating from about 1814.

Götz. *Deuts. Rundschau G.* **33** (1910–11): 391–393. **Reindl.**

Wilhelm Götz. Von D. Josef Reindl. *Portrait.*

Harrisse. **Vignaud.**

Henry Harrisse. Étude biographique et morale, avec la bibliographie critique de ses écrits. Par Henry Vignaud. Paris: Ch. Chadenat, 1912. Size 9 × 5¼, pp. 84.

Hooker. *Kew B.* (1912): 1–34. ——

Sir Joseph Dalton Hooker, 1817–1911. *Portrait.*

Verbiest. *B.S. Belge d'Études Col.* **18** (1911): 825–841. **Gueluy.**

Un mandarin belge, Ferdinand Verbiest, Missionnaire et Astronome. (Pitthem, 1623—Peking, 1688.) Par R. P. Alb. Gueluy. *Portraits.*

One of the band of Jesuits who did so much for science in China in the seventeenth century.

Vespucci. **Vignaud.**

Americ Vespuce. Ses voyages et ses découvertes devant la critique. Par Henry Vignaud. (Extrait du *Journal de la Société des Américanistes de Paris.* Nouvelle série, tome viii., 1911.) [Paris], 1911. Size 11 × 7½, pp. 23–54.

See note in the Monthly Record, *ante*, p. 221.

GENERAL.

Bibliography—Catalogue. **Royal Society.**

Catalogue of a collection of early printed books in the library of the Royal Society. London, 1910. Size 10 × 7½, pp. 120. *Presented by the Royal Society.*

Noticed in vol. **39**, p. 481.

Bibliography—Maps. **Fordham.**

Descriptive catalogues of maps. A paper read before the Bibliographical Society, November 21, 1910. By Sir Herbert George Fordham. London, 1912. Size 9 × 7, pp. 32.

British Empire. **Sargent.**

The sea road to the East: Gibraltar to Wei-hai-wei. Six lectures, prepared for the Visual Instruction Committee of the Colonial Office by A. J. Sargent. London: G. Philip & Son, 1912. Size 7½ × 5, pp. viii. and 124. *Sketch-maps and Illustrations. Price* 1*s. net. Presented by the Publishers.*

Dutch colonies. **Leclercq.**

La Colonisation chez les Hollandais. Par Jules Leclercq. (Association des Licenciés sortis de l'Université de Liége.) [Liége], 1911. Size 9½ × 6½, pp. [26].

Education. *J.G.* **10** (1912): 245–262. **Gregory and others.**

Symposium upon what is most needed in the teaching of elementary geography. Conducted by W. M. Gregory, with opinions by others.

Education. *Ymer, Ts. Svenska S.G.* **32** (1912): 88–102. **Nelson.**

Om Kulturgeografien i skolan. Af Helge Nelson. *Illustrations.*

Education. **Craig.**

Secrets of the hills and how Ronald read them. By Sterling Craig. London: G. E. Harrap & Co., [1912]. Size 8 × 6, pp. 320. *Illustrations. Price* 3*s.* 6*d. net. Presented by the Publishers.*

Education—Map-drawing. **Johnson.**

Practical exercises in Map Drawing. By Douglas Wilson Johnson. Boston: J. L. Hammett & Co., [1911]. Size 8½ × 6, pp. 20. *Diagrams.* [*Sketch-maps in separate case.*]

Education—Readers. **Page.**

Lands and their peoples: a new series of geographical readers for young children. By J. W. Page. The frozen North and the Eskimo (pp. 32); The Great Desert and its people (pp. 32); China and its people (pp. 32); The prairies and the Indians (pp. 32). London: Macdonald & Evans, [1912]. Size 7 × 5. *Illustrations. Price 2d. each.*

Elementary sketches of life and nature in distant lands, no doubt suitable for their purpose.

Education—Text-book. **Simmons and Stenhouse.**

A class book of physical geography. By A. T. Simmons and Ernest Stenhouse. London: Macmillan & Co., 1912. Size 7½ × 5, pp. viii. and 436. *Sketch-maps, Illustrations, and Diagrams. Price 4s. 6d. Presented by the Publishers.*

Education—Wall-maps. **Unstead and Taylor.**

Philips' Comparative Series of Wall Atlases of the Continents. Edited by J. F. Unstead and E. G. R. Taylor. Explanatory Handbook. Set I.: Europe. London: G. Philip & Son, 1911. Size 8½ × 5½, pp. 16. *Price 6d. net. Presented by the Publishers.*

Essays. **Johnston.**

Views and reviews from the outlook of an anthropologist. By Sir Harry Johnston. London: Williams & Norgate, 1912. Size 7½ × 5, pp. vi. and 314. *Price 3s. 6d. net. Presented by the Publishers.*

These essays, originally contributed to various magazines and concerned with a variety of subjects and countries (Africa, Ireland, Germany, the racial problem, etc.), have been entirely rewritten for this collected edition.

Hints to Travellers. **Reynolds-Ball.**

Outfit and equipment for the traveller, explorer, and sportsman. Edited by Eustace Reynolds-Ball. London: Reynolds-Ball's Guides, 1912. Size 8½ × 6½, pp. 144. *Illustrations. Price 2s. 6d. nt. Presented by the Editor.*

See review in the July number, p. 81.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

British Isles—Scotland. **Railway Clearing House.**

Official Railway Map of Scotland. Scale 1 : 475,200 or 1 inch to 7·5 stat. miles. Prepared and published at the Railway Clearing House, London, 1912. 2 sheets. *Price 8s. 6d.*

Europe. **Duncker.**

Grosser Atlas der Eisenbahnen von Mittel-Europa. Nach amtlichen Quellen neu bearbeitet und vervollständigt. Herausgegeben von Alexander Duncker in Leipzig. XVIII. Auflage. Berlin, Leipzig, Hamburg: Verlag für Börsen- und Finanzliteratur A.-G., 1912.

Germany. **K. Preuss. Landesaufnahme.**

Karte des Deutschen Reiches. Königreich Preussen. Herausgegeben von der Kartogr. Ableitung der Königl. Preuss. Landesaufnahme. Kupferdruck-Ausgabe. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Sheet 374, Rawitsch. Berlin: R. Eisenschmidt, 1911. *Price 1.50 M. each sheet.*

Germany. **K. Sächs. Generalstabes.**

Karten des Deutschen Reiches. Königreich Sachsen. Herausgegeben von der Abteilung für Landesaufnahme des Königl. Sächs. Generalstabes, 1912. Umdruckausgabe. Scale 1 : 100,000 or 1 inch to 1·6 stat. miles. Sheet 476, Greiz. Dresden: G. A. Kaufmann, 1912. *Price 50 Pf. each sheet.*

Germany. **Vogel.**

Karte des Deutschen Reichs im Massstab 1 : 500,000 (1 inch to 7·8 stat. miles) unter Redaktion von Dr. C. Vogel. Sheets: 14, Berlin; 15, Frankfurt a. O.; 19, Dresden; 20, Görlitz. Gotha: Justus Perthes, 1911–12.

Greece. **Greek General Staff.**

Map of Greece. [In Greek.] Scale 1 : 75,000 or 1 inch to 1·2 stat. miles. Sheet: Aedipsos. Athens: General Staff; Vienna: K. u. K. Militär-geographisches Institut, 1909.

This is an additional sheet of the new Government Survey map of Greece which was noticed in the *Geographical Journal* for August, 1911.

Italy. **Istituto Geografica Militare, Florence.**

Carte Corografica d'Italia. Scale 1 : 200,000 or 1 inch to 3·2 stat. miles. Sheets: 1, Domodossola; 7, Monte Bianco; 8, Aosta; 9, Novara; 15, Oulx; 16, Torino; 17, Alessandria; 22, Argentera; 23, Cuneo; 24, Genova; 29, S. Remo—Porto Maurizio. Florence: Istituto Geografico Militare, 1910. *Price* 1.50*L. each sheet.*

Russia. **Topographical Dept., General Staff, St. Petersburg.**

Map of European Russia. [In Russian.] Scale 1 : 420,000 or 1 inch to 6·6 stat. miles. Sheets 13 and 26. St. Petersburg: Topographical Dept., General Staff, 1912.

Spain. **Direccion General de Obras Públicas, Madrid.**

Map of Spain, showing railways, roads, and waterways. [In Spanish.] Scale 1 : 1,000,000 or 1 inch to 15·8 stat miles. 2 sheets. Madrid: Department of Public Works, 1912.

An outline map of Spain in two sheets, without hills, showing by different symbols and colours existing and proposed roads and railways, according to their class and importance. Lights round the coast are also indicated, and by special symbols the relative importance of cities and towns can be seen at once.

ASIA.

China. **'Les Missions Catholiques.'**

L'Église Catholique en Chine. Partie Orientale. Scale 1 : 3,000,000 or 1 inch to 47·3 stat. miles. Supplement to 'Les Missions Catholiques,' 1912. Lyon, 1912.

India. **Surveyor-General of India.**

Maps published by the Survey of India during the quarter ending March 31, 1912. India, railway, canal and road map, 1 inch to 32 miles: Degree sheets, 1 inch to 4 miles, Afghanistan and North-West Frontier Province, 1 sheet; Bengal, 3 sheets; Eastern Bengal and Assam, 1 sheet.—Standard sheets, 1 inch to 1 mile, Bengal, 2 sheets; Bombay, 1 sheet; Burma, 6 sheets; Central Provinces, 2 sheets; Eastern Bengal and Assam, 4 sheets; Madras and Mysore, 2 sheets; Mysore and Coorg, 1 sheet; Punjab, 2 sheets; Punjab and Kashmir and Jammu, 1 sheet; United Provinces, 3 sheets; United Provinces and Central India, 1 sheet. Calcutta: Map Record and Issue Office, 1912. *Presented by the Surveyor-General of India.*

Malay Archipelago. **Topographical Bureau, Batavia.**

Schetskaart van het Eiland Wetar. Scale 1 : 150,000 or 1 inch to 2·4 stat. miles. —Schetskaart van het Eiland Adonara. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Batavia: Topographical Bureau, 1911.

The island of Wetar is in about lat. 8° S. and long. 126° 30′ E., and that of Adonara in 8° 20′ S. and 123° E. They are two of the less frequented islands of the Netherland East Indies, and no regular survey of them has been made. The present maps are from the best sources that exist, including the charts of the coast, and as regards the latter, a sketch-map made by Captain J. D. H. Beckering in 1910.

Russia. **Military Topographical Dept., St. Petersburg.**

Map of the Southern Frontier Regions of Asiatic Russia. [In Russian.] Scale 1 : 1,168,031 or 1 inch to 18·4 stat. miles. Sheets: II. Astrakan-Orenburg; IV. Omsk-Tomsk; VI. Irkutsk; VII. Blagoveschensk-Tsitsikar; VIII. Vladivostok; XIV. Urga. St. Petersburg: Military Topographical Department, 1912.

Turkey in Asia. **Geographical Section, General Staff.**

Sketch-map to show, approximately, railways in Asiatic Turkey. Scale 1 : 7,500,000 or 1 inch to 118·4 stat. miles. Published by the Geographical Section, General Staff, War Office. London Agents: E. Stanford, Sifton Praed, T. Fisher Unwin, 1911. *Price* 1*s. net.*

AFRICA.

Africa. **Geographical Section, General Staff.**

Africa. Scale 1: 250,000 or 1 inch to 3·9 stat. miles. Eastern Africa Protectorate. (Provisional) Sheets: North A 37-T, Meru; South A 37-C, Manzola; South A 37-I, Kitui; South A 37-O, Yatta Plateau. Published by the Geographical Section, General Staff, War Office, 1912. London agents: E. Stanford, Sifton Praed, T. Fisher Unwin. *Price* 1*s.* 6*d. each. Presented by the Director of Military Operations.*

Africa. **Survey Office, Khartum.**

Africa. Scale 1: 250,000 or 1 inch to 3·9 stat. miles. Anglo-Egyptian Sudan. Sheets: 35-N, No. 6 Railway Station; 78-N, Gondokoro; 78-O, Oboya; 86-B, Dufile. Khartum: Survey Office, 1912. *Price* 10 *P.T. each sheet. Presented by the Director of Surveys, Khartum.*

British East Africa. **Ward and Milligan.**

Sketch-map of East Africa Protectorate showing Game Reservations and Uganda Railway, etc. Scale 1: 1,500,000 or 1 inch to 23·6 stat. miles. Prepared for 'Handbook of British East Africa, 1912,' compiled by H. F. Ward and J. W. Milligan. London: Sifton Praed & Co., Ltd.; Nairobi: Caxton (B.E.A.) Printing and Publishing Co., Ltd., 1912. *Price* 2*s. Presented by Messrs. Sifton Praed & Co.*

AMERICA.

Canada—Alberta. **Department of the Interior, Ottawa.**

Cereal map of Alberta, showing acreage under crop in each township in Wheat, Oats, Barley, and Flax, 1910. Scale 1: 792,000 or 1 inch to 12·5 stat. miles. Cereal information prepared in the Railway Lands Branch under the direction of F. C. C. Lynch, Superintendent, from data supplied by Provincial Government. Second Edition. Ottawa: Department of the Interior, [1912]. *Presented by the Superintendent, Railway Lands Branch, Department of the Interior, Ottawa.*

Ecuador. **Saville.**

Provinces of Manabi and Guayas, Ecuador. Compiled from various sources and notes of Marshall H. Saville, of the George G. Heye Expedition. Scale 1: 729,300 or 1 inch to 11·5 stat. miles. New York, 1910. *Presented by the Author.*

Includes the coast territory of Equador from 0° 30′ N to 3° S. as laid down from the survey of this expedition, the route of which is shown in red. The map has been prepared to accompany Prof. Marshall H. Saville's work on "The Antiquities of Manabi, Ecuador."

GENERAL.

World. **Debes.**

E. Debes' Neuer Handatlas über alle Teile der Erde in 65 Haupt und über 130 Nebenkarten mit alphabetischem Namenverzeichnis 4. stark vermehrte verlesserte Auflage. Lieferungen 15u. 16. Leipzig: H. Wagner and E. Debes, 1912. *Price* 80 *Pf. each part.*

These parts contain the following maps: Lieferung 15: No. 12ª Europa, Flus- und Gebirgskarte; 42 Süd-Asien. Lieferung 16, No. 18 Belgien und die Niederlande. 40ª Kleinasien (Anatolien).

World. **Ward, Prothero, and Leathes.**

The Cambridge Modern History Atlas. Edited by A. W. Ward, LITT. D., F.B.A., G. W. Prothero, LITT. D., F.B.A., Stanley Leathes, M.A., C.B., assisted by E. A. Benians, M.A. Cambridge: The University Press, 1912. *Price* 25*s. net. Presented by the Publishers.*

In this atlas is traced the various stages by which Europe of the fifteenth century has developed into the various countries and states of which it is composed in the present day. By means of 141 coloured maps, some of which contain several insets, the whole history of Europe from 1490 A.D. is dealt with in a thorough manner, the rise and fall of states and the continual change in boundaries and frontiers being clearly exhibited. The maps are not entirely restricted to the continent of Europe, but trace the development and expansion of European possessions abroad, the first of these, No. 2, entitled "The Age of Discovery," showing the voyages of Columbus, John Cabot and Magellan, with the territorial possessions of Spain and Portugal. Twelve maps are devoted to the expansion of British oversea possessions, some of which are of a specially interesting nature. Most of the maps are coloured, and their boundaries and territorial divisions can be followed without difficulty, but in several of them the

hill shading, given in black vertical hachures, is far from satisfactory, and tends rather to confusion than elucidation.

The arrangement of the atlas follows as far as possible the order of 'The Cambridge Modern History,' and an endeavour has been made to insert the names referred to in that work; yet it is intended that the atlas should constitute in itself an independent atlas of modern history. The introduction, consisting of 118 pages of text, has been written by Mr. Benians, Fellow and lecturer of St. John's College, who also, under the supervision of the editors, carried out the work of constructing the maps.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, from June 2 to 29, 1912. *Presented by the Hydrographer, Admiralty.*

New Charts—Chart of Spithead, showing position of the Fleet on July 9, 1912, 3*s*. No. 145, Arabian sea: Plans on Makran coast: Khor Rabij, 2*s*. 3771, Bay of Bengal: Andrew bay to Calventuras, 4*s*. 1259, Korea: Fusan (Pusan) harbour, 3*s*. 771, Plans in Liu kiu islands: Yakiuchi bay (inner part), 2*s*. **New Editions**—No. 1598, England, south coast: English channel, 5*s*. 2767, Ireland, west coast: Sligo and Killala bays, 3*s*. 1039, Skagerrak: Christiania harbour, 2*s*. 1843, Africa, south-east coast: East London harbour and approaches, 2*s*. 650, Plans on the east coast of Africa: Innambán (Inhambane) river (New Plan of Kilimán (Quilimane) river on this sheet), 3*s*. 2089, Africa, east coast: Tugela river to Delagoa bay (Plans: St. Lucia bay, Sordwana road, Entrance to Kosi river), 3*s*. 1064, Plans on the north-east coast of Madagascar: Port Nièvre and Cul-de-sac Gallois anchorages (New Plan of Oronjia pass and anchorage on this sheet), 2*s*. 3214, Red sea: Ports Ibrahim and Thewfik, 2*s*. 1641, Harbours and anchorages on the coast of Formosa: Tankan road (Toko hakuchi), (New Plan of Taihanroku anchorage on this sheet), 2*s*. 3133, Australia, east coast: Cairns harbour, 3*s*. 769, Pacific ocean: Admiralty and Hermit islands (Plans: Nares harbour, Alacrity harbour, St. Andrew anchorage, Carola bay), 2*s*. 1103, Plans in the West Pacific ocean: Helen reef, Mapia islands, Los Martires, Sorol or Philip islands (New Plans of Palau or Pelew islands, and Malakal harbour and Gorör (Korror) road on this sheet. Plan added: Angaur island), 2*s*. 1490, Pacific ocean: Harbours and anchorages in the Sandwich islands: Waimea bay (Kauai), Waianae, Hanamaulu bay, Kaunakakai harbour, Kamalo harbour, Mahukono harbour, Pukoo harbour, Lahaina roads, Kapuookahi bay, Waialua bay, Kawaihae bay, Waimea bay (Oahu), Kaanapali anchorage, 3*s*.

(*J. D. Potter, Agent.*)

Atlantic, North. **U.S. Hydrographic Office.**

Pilot chart of the North Atlantic Ocean, June, 1912. Washington: U.S. Hydrographic Office, 1912. *Presented by the U.S. Hydrographic Office.*

Atlantic, North. **U.S. Weather Bureau.**

Meteorological chart of the North Atlantic Ocean, July, 1912. Washington: Department of Agriculture, U.S. Weather Bureau, 1912. *Presented by the U.S. Weather Bureau.*

Atlantic, North, and Mediterranean. **Meteorological Office.**

Monthly Meteorological charts of the North Atlantic and Mediterranean, July, 1912. London: Meteorological Office, 1912. *Price 6d. each. Presented by the Meteorological Office.*

Burma. **Hunton and Smith.**

Burma. Rangoon river, Kyauktan or Hmawun creek to Elephant point. Surveyed November and December, 1911, and January, 1912, by A. S. Hunton, River Surveyor, and V. G. Smith, Assistant River Surveyor, under the direction of H. G. G. Ashton, Deputy Conservator of the Port. Scale 1 : 18,153 or 3·5 inches to 1 stat. mile. Rangoon: Commissioners for the Port of Rangoon, 1912. *Presented by H. G. G. Ashton, Esq., Deputy Conservator for the Port of Rangoon.*

Indian Ocean. **Meteorological Office.**

Monthly Meteorological charts of the Indian Ocean, July, 1912. London: Meteorological Office, 1912. *Price 6d. each. Presented by the Meteorological Office.*

Indian Ocean. **U.S. Hydrographic Office.**

Pilot chart of the Indian Ocean, August, 1912. Washington: U.S. Hydrographic Office, 1912. *Presented by the U.S. Hydrographic Office.*

Indian Ocean. **U.S. Weather Bureau.**

Meteorological chart of the Indian Ocean, July, 1912. Washington: Department of Agriculture, U.S. Weather Bureau, 1912. *Presented by the U.S. Weather Bureau.*

North America. **U.S. Weather Bureau.**

Meteorological chart of the Great Lakes, July, 1912. Washington: Department of Agriculture, U.S. Weather Bureau, 1912. *Presented by the U.S. Weather Bureau.*

Norway. **Norges Geografiske Opmaaling.**

Kystkarter: Nr. 68, Steigen til Tranöy; 69; Tranö til Raftsund og Tjeldsund; 77, Tjeldsund til Harstad or Lavangen; 87, Gryllefjord og Bergsfjord til Hekkingen; 319, Fleina og Sandhornet til Tranö. Christiania: Norges Geografiske Opmaaling, 1912. *Presented by the Norwegian Geographical Institute.*

Pacific, North. **U.S. Hydrographic Office.**

Pilot chart of the North Pacific Ocean, August, 1912. Washington: U.S. Hydrographic Office, 1912. *Presented by the U.S. Hydrographic Office.*

Pacific, North. **U.S. Weather Bureau.**

Meteorological chart of the North Pacific Ocean, July, 1912. Washington: Department of Agriculture, U.S. Weather Bureau, 1912. *Presented by the U.S. Weather Bureau.*

PHOTOGRAPHS.

California. **Newman.**

Twenty-two picture post-cards of the Californian Missions. Los Angeles and San Francisco: The O. Newman Co. *Presented by H. T. Burls, Esq.*

These picture post-cards are bound in the form of a small album, but they are perforated for tearing off as required for use. A brief description is printed at the side of each, from which the following titles have been taken:—

(1) San Diego mission, 1769; (2) San Carlos Borromeo (El Carmel mission) near Monterey, 1770; (3) Mission San Antonio de Padua, 1771; (4) San Gabriel mission, 1771; (5) Mission San Luis Obispo de Tolosa, 1778; (6) San Francisco de Asis, Mission Dolores, 1776; (7) San Juan Capistrano mission, 1776; (8) Mission Santa Clara de Asis, 1777; (9) Mission San Buenaventura, 1783; (10) Santa Barbara mission, 1786; (11) Ruins of Mission La Purisima Conception, 1787; (12) Santa Cruz mission, 1791; (13) Nuestra Senora de La Soledad, 1791; (14) Mission San Jose de Guadalupe, San Jose, 1797; (15) San Juan Bautista mission, San Juan, 1797; (16) Mission San Fernando, Rey de Espagna, 1797; (18) Mission San Luis, Rey de Francia, 1798; (19) Mission Santa Ines, 1804; (20) Mission San Rafael, Archangel, 1817; (21) Mission San Francisco Solano de Sonoma, 1823; (22) Los Angeles mission chapel from the Plaza.

Newfoundland and Labrador. **Reeve.**

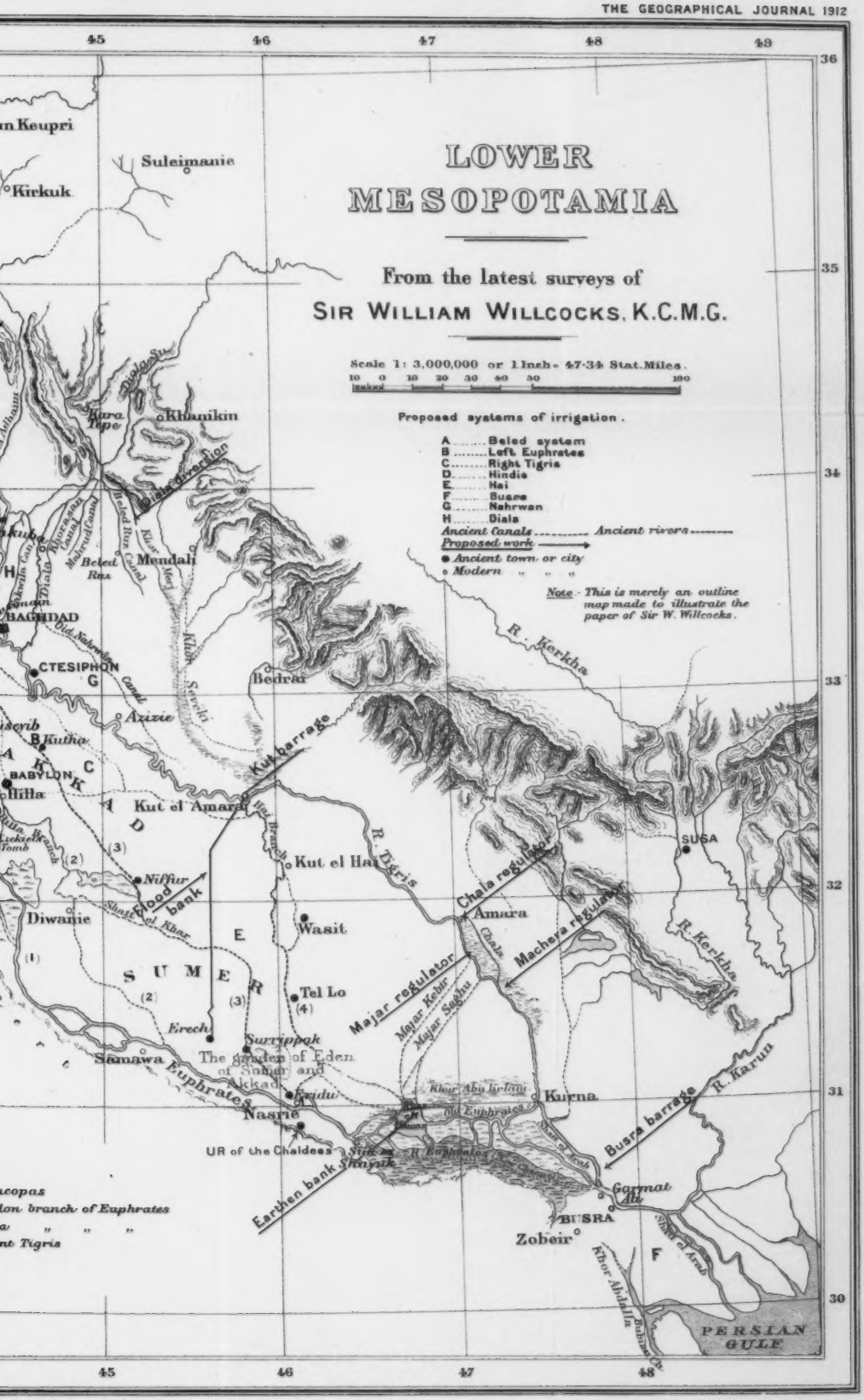
Sixteen photographs of Newfoundland and Labrador, taken by Henry Reeve, Esq., C.M.G. *Presented by Henry Reeve, Esq., C.M.G.*

A good and characteristic set of panoramas, measuring 3¾ by 12¼ inches. The titles are as follows:—

(1) St. Johns from the roof of Government House; (2) St. Johns, the valley above the docks; (3 and 4) St. Johns, the dock gates; (5) St. Anthony's harbour, Dr. Grenfell's headquarters; (6) Straits of Belle Isle; (7) Belle Isle; (8) Kitty's harbour; (9) Approaching Chateau Belair; (10) Outer harbour, Battle; (11) Gready island; (12) North-west river, Hamilton inlet; (13) The Hudson Bay Co.'s post at Rigoulette; (14) Kenemich river, Hamilton inlet; (15) Hopedale, the Moravian mission station; (16) Nain Run, looking east.

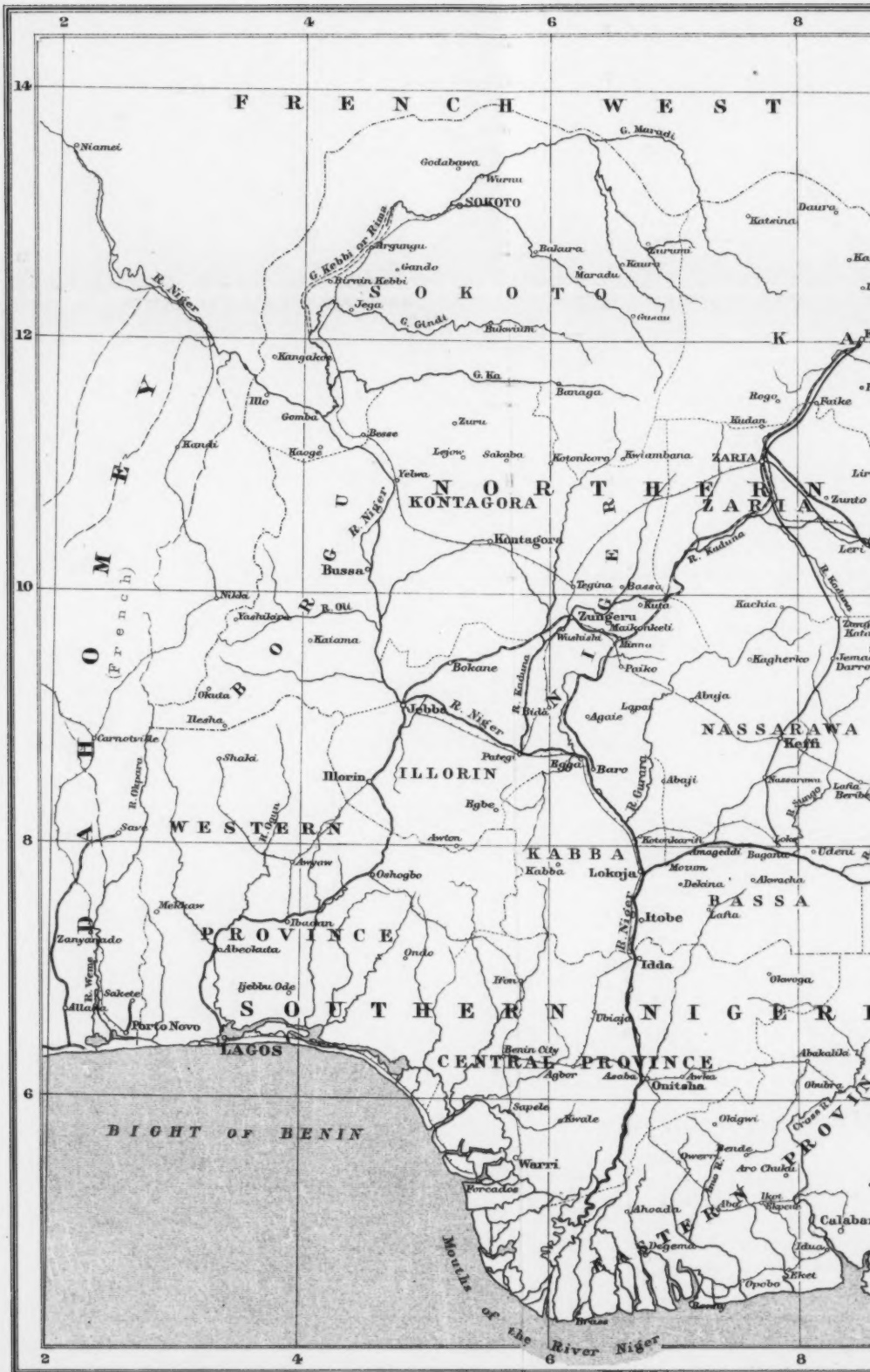
N.B. It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

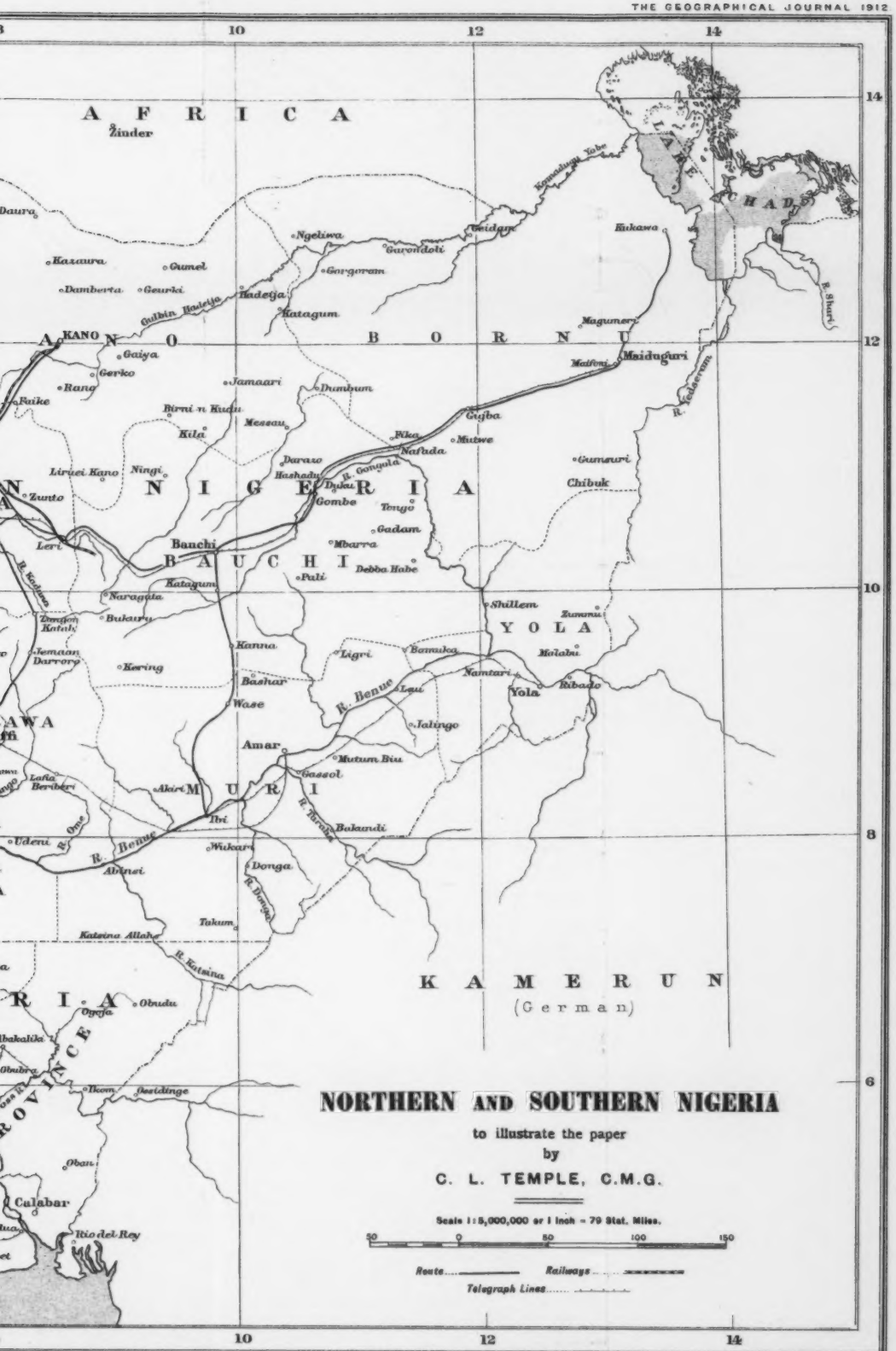
Published by the Royal Geographic



yal Geographical Society.

LOWER MESOPOTAMIA
WILLCOCKS


FRENCH WEST
SOKOTO
SOKOTO
NORTHERN
KONTAGORA
ZARIA
BORGU
DAHOMEY (French)
WESTERN
PROVINCE
ILLORIN
KABBA
BASSA
NASSARAWA
CENTRAL PROVINCE
SOUTHERN NIGERIA
LAGOS
BIGHT OF BENIN
Mouths of the River Niger
R. Niger
R. Kaduna
R. Benue
Niamei
Sokoto
Kontagora
Bussa
Zungeru
Kano
Zaria
Ilorin
Jebba
Lokoja
Idda
Onitsha
Warri
Calabar
Port Novo
Abeokuta
Ibadan
Oshogbo
Benin City
Owerri
Aro Chuku
Opobo
Eket
Degema
Forcados
Sapele
Agbor
Awka
Abakaliki
Udi
Nsarum
Keffi
Abuja
Kagheroe
Bauchi
Kuta
Bassa
Baro
Egga
Patigi
Bokane
Yelwa
Kaiama
Okuta
Ilesha
Shaki
Oyo
Ogbomosho
Awaye
Ondo
Ife
Ijebu Ode
Sakete
Attakpa
Carnotville
Zanyanado
Meko
Awyaw
Asaba
Ahoada
Abo
Ikot Ekpene
Uyo
Itu
Oron
Ikang
Bende
Ohaozara
Abakaliki
Okigwi
Ogoja
Mamfe
Kumba
Victoria
Bonny
Brass
Degema
Ikoli
Ibo
Ibeno
Ikang
Ikot Ekpene
Uyo
Itu
Oron
Opobo
Eket
Bende
Aro Chuku
Okigwi
Owerri
Ohaozara



NORTHERN AND SOUTHERN NIGERIA

to illustrate the paper

by

C. L. TEMPLE, C.M.G.

Scale 1:5,000,000 or 1 inch = 79 Stat. Miles.

50 0 50 100 150

Route ——— Railways ——— ———

Telegraph Lines .....

the Royal Geographical Society.

NIGERIA.
Temple.